MODEL AIRPLANE NEWS

HOW TO AVOID CRASHES

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120 August 1995

TOP GUN '95

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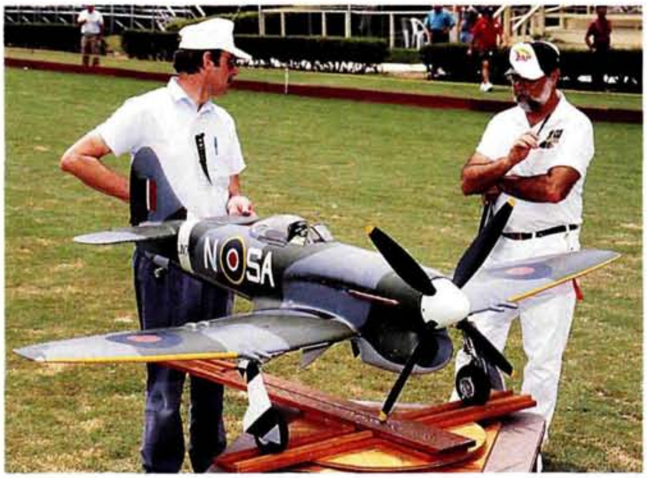
AUGUST 1995 VOLUME 123, NUMBER 8

MODEL AIRPLANE NEWS

FEATURES



ABOVE: Sepp Uberlacher holds the tail of his Hawker Tempest during static judging at the 1995 Top Gun Scale Invitational.

ON THE COVER: main photo—Bud Roane's Sopwith Pup heads off for another sortie—13th in Expert. Bud has continually improved his flight scores by flying in as scale-like a manner as possible. Insets: top—Ralf Ploenes of Germany executes a tank drop with his BVM P-80 Shooting Star (photo by Walter Sidas). Bottom (left to right): Sepp Uberlacher's Hawker Tempest—winner, High Static Expert; fifth-place Team scale T-33 Thunderbird by Steve Elias and Ian Richardson executes a beautiful slow roll—winner, Best Aerobatic Performance; Bob Underwood, 21st Expert, walks his Hiperbipe to the pilots' box.

FEATURES

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COLUMNS

COLUMNS

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EDITORIAL

TOM ATWOOD

SCALE-UP SCALE

As we worked on the Top Gun feature story, we were reminded of the importance of the smaller scale meets held each year, many of which do not receive regular press coverage. The airplanes shown here were among the many beautiful scale models campaigned at the Gator Shootout—a scale invitational held last January at R.C. World, near Orlando, FL. Organized by the indefatigable Wally Zober, this three-day event—although modest in comparison to Top Gun—was, nonetheless, a real scale showcase. Nearly three dozen planes were judged in one of three classes: Team Scale, Expert and Designer Scale. The event's success was all the more impressive given sporadic stormy weather.

Pat Rogers' Stinson Reliant SR8, which won Best of Show at the Gator Shootout, shows off Canadian registry colors. This gull-wing, 18-pound classic has a wingspan of 103 inches. It also took Best of Show and Best Finished Airplane at Giants over Deland in '94.

The aircraft was built from Wylam drawings and Ikon N'West plans out of balsa and ply. Pat incorporated steering wheels of hand-turned spruce, and the dashboard is also spruce. The cabin walls are lined with kid-glove leather. Fifty dollars' worth of fine brass screws hold the windshield panels in place—a faithful miniaturization of the full-scale design. The wheel pants and the cowl were supplied by Fiberglass Masters. The plane is covered with light Ceconite cloth and is flawlessly finished with nitrate dope, primer and K&B paint, paralleling the finish on the original. A Zenoah G-38 engine spins a 19x6 prop to power the craft; Du-Bro wheels handle terrestrial travel. A JR radio uses five of its channels; the fifth is for flaps. Pat has a dedicated servo operating the tail wheel (Y-harnessed on the rudder channel).

Bill Setzler created plans for his 124-inch-span, 27-pound Fokker Eindecker III by blowing up drawings published in "Aircraft in Profile" (Doubleday). The model is covered in Coverite, coated with Aeroglass dope and powered by a G-38 spinning a Zinger 20x6 prop. The wing-warping mechanisms are miniatures of those on the original, as are the full-flying elevator and rudder. A Futaba sail-winch servo transmits force to the aft section of the wings via a structure mounted below the fuselage. A "tower" above the fuse and wings has pulleys that allow the warping wires to complete the pull/pull circuit. Landing gear and tower structures are silver-soldered, $\frac{3}{8}$-inch stainless-steel and brass tube. Ribs are made of balsa; bulkheads are made of ply. Proctor wheels have outlasted Bill's original scratch-built version.

Modelers spend countless hours on projects such as these, and the techniques used are of wide interest. If there were more local scale contests, there would be a greater opportunity for the modeling press (and other media) to spread the word—and not just to other modelers. That's why we believe there should be more events like the Gator Shootout around the country.

If your club holds a local scale contest, we may have an interest in reporting on the most impressive models. But where do you start? Wally sent out letters to manufacturers and distributors to solicit sponsorship, and he contacted local hobby shops and flying clubs within 50 miles of R.C. World. He also developed a list of noted scale modelers in nearby states.

Other considerations: would your club hold an open scale contest or an invitational? Would you include categories other than expert, team and designer scale? Wally, who has generously offered to advise clubs on these and related matters, can be reached at (407) 880-1298. He's setting up the third annual Gator Shootout for February of next year. What about scoring? Simply Scale Scoromaster ($29.95)—new software designed for scale contests by experienced scale modeler and contest judge Cliff Tacie—is available from Seneca Ridge Services at (410) 641-9458. Take a chance, hold a contest, and don't forget to let us know! ■

Joe Saitta's scratch-built, 17-pound, 106-inch-wingspan B-29 is powered by four O.S. .40 FPs spinning 10x6 Master Airscrew props. Six channels include bomb release and retracts. The all-balsa and plywood design features custom cowls made of 0.6-ounce fiberglass and polyester resin. Joe stretch-formed the windowpanes on the cockpit out of butyrate plastic. In the three years it has been campaigned, the plane has won many awards, including third place at the King Orange and Mulberry meets. Rhom-Air retracts, Robart wheels and an acrylic-lacquer-plus-clearcoat finish top off the impressive model.

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WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

KUDOS TO CARL

I appreciate encountering an article with wit and substance, such as Carl Risteen's "Improving Flight Performance" in the June '95 issue of *Model Airplane News*. He combined a discussion of realistic concerns about aircraft control with basic engineering and aerodynamics background, and with a historical perspective that's also nice.

I also appreciate the article's humor and wit. I hope we, as modelers and technical types, can learn to indulge our authors a bit in terms of the technical presentations and avoid some of the confrontational retorts that have shown up in the past few years over articles of this type. Physics is physics no matter how you cut it, and there's something to be gained from almost any method of presentation. So, kudos for a good article and a flair for presentation.

SCOTT WINANS
Tucson, AZ

Scott, we're pleased to hear that you enjoyed Carl Risteen's article so much. We're sure that you'll find Part 2 (July '95 issue) and Part 3 (this issue) just as informative and engaging. GY

P-47 QUEST

I've recently acquired one of the original Burt Baker P-47 Thunderbolts with the bubble canopy but, unfortunately, there weren't any plans, instructions, etc., with this semi-kit.

Does anyone have plans or any information that they could copy and send to me? I've contacted Yellow Aircraft, but their P-47 has been completely revised. Any help you or your readers could give me would be greatly appreciated. You have a great magazine; keep up the good work.

DAVID WALKER
18234 Vine St., Hesperia, CA 92345

David, we hope that our readers will come to your rescue with plans and instructions. Good luck, and happy flying! GY

IN SEARCH OF...

I got into the R/C airplane hobby in 1969 (with the Charleston R/C Society) while stationed in Charleston, SC. My first plane was a New Era, which I built from a then-current issue of *Model Airplane News* to 150 percent of the original size.

About a year later, I was transferred to Rota, Spain, and was one of the founders of the Rota Modelers Club. When I left the service in 1973, I founded another club in South Jersey, but I had to give up my efforts because of work and family commitments. I'm getting back into the hobby after an 18-year absence.

The other day, I began to think about the wonderful people who formed and participated in these clubs, and I'd like to hear from them again. I've lost track of them all. Please publish my name, address and telephone number; I hope some of them will get in touch with me.

THOMAS J. DAGOSTINO
301 Harding Hwy., Landisville, NJ 08326; (609) 697-1770.

CAD-ING A GEE BEE

I'm a big fan of Gee Bees, so I was excited to see Henry Haffke's construction article in your December '94 issue. I live and work near where the Auburn and Cord automobiles were built when Gee Bees were racing; you can see the same superb art deco design elements in the lines of those cars and in all the Gee Bees.

I'll build and fly the Gee Bee someday, but first, I must finish my Andy Lennon Swift. To get the feel of the Gee Bee, I began to model it in 3-D using a pair of design tools that I have running on a personal computer. The airfoil was done using Compufoil. The 2-D foil was then copied into my

CADKEY 6.0 modeling program.

When I've finished, I will be able to plot exact scale patterns of all the parts. The 3-D modeling enables me to "see" all the construction elements, and then to design lightness and reinforcement into the design where needed.

I've never built an R/C model before this one using CAD, but I find the challenge rewarding and enjoyable.

GENE DAVIS
Ft. Wayne, IN

Gene, computers have had a revolutionary effect on almost every aspect of our lives. From designing and manufacturing automobiles to producing "Model Airplane News," computers play an ever-increasing role. R/C modeling is making great designing and manufacturing strides with the help of computer-aided design (CAD) programs. Computer 3-D modeling is a fantastic way to see a plane before you build it; and the on-screen image can show potential problems in design before a single piece of wood has been cut. Some R/C kit manufacturers now use CAD programs for their design, drafting and manufacturing processes.

I just learned that the new Midwest Products Super Stinker biplane kit was designed using CAD. When the designers at Midwest started on the model, they acquired the full-size aircraft's plans on a CAD disk. They then pulled up the fuselage and wings on their computer screen, erased the full-size structures, filled in the outline with model structures and printed out their new model plans (I'm greatly simplifying the procedure). Design changes are easy to make, and re-drawn plans are easy to print out again. From laser and hydro cutting technology and custom-cut vinyl model graphics to the highly detailed computer-drawn plans in many kits, CAD programs give us a measure of accuracy that wasn't possible before. When you get your Gee Bee finished, please send us a photo for "Pilot Projects"; then we might scan it into a issue of "Model Airplane News" using our Photo Shop computer software. GY ■

HOW TO

AVOID CRASHES!

Save your model from being “re-kitted”

by ROGER POST JR.

IN 30 YEARS of flying R/C, I have become well-versed in the art of getting out of crash situations. My training as a full-scale pilot has sharpened my understanding of some of these techniques. Recently, while watching videotapes of model crashes (“Oops” and “Son of Oops,” produced by Propwash Video Productions, 2973 Berman St., Las Vegas, NV; 702-731-5217), I realized that a number of crashes could have been avoided had the pilots better understood how and when to use throttle and rudder. Left-hand inputs (throttle and rudder—assuming you fly in Mode II) are critical to surviving stalls or near-stall situations at low altitude, yet many modelers instinctively input aileron and elevator commands and lose their models in the process. Many models in the videos could have been saved had other guidelines been followed. So I would like to share some of these procedures with you.

When I was training for my pilot’s license, everyone commented on how long I took to preflight an aircraft. Well, I just let them talk, because I knew that a thorough preflight could save my life. The same approach can be applied to your model.

Using preflight checklists also helps to minimize crashes. I’ve included sample checklists here.

ON THE FLIGHT LINE

Once all checks have been completed, you’re ready for flight. Takeoffs are often the first point of a crash. When you start your ground run, simultaneously increase power and add a little right rudder. As the plane gathers speed and tends to veer left, increase the right rudder input. Don’t try to correct the left-hand veering tendencies with aileron. Ailerons are ineffective at slow air speeds, and they will only cause adverse yaw, i.e., the downward-deflected aileron generates drag that pulls that wing back. The left-hand turning is a yaw problem, and rudder corrects yaw.

Once the plane has reached an adequate air speed, pull the elevator stick back a degree or two. The airplane should climb out at a nice 20- to 30-degree angle to the horizon. On your climb-out, keep your wings level with the ailerons, and kee your ground track straight with the rudder.

STALLING ON CLIMB-OUT

After your plane has taken off, don’t pull th nose up too high, or you will lose air spee and stall the wing. The only way to save model that has stalled is to push the elevato stick forward to decrease the angle of attac and increase air speed (Photo 1). If you ar not already at full throttle, add throttle.

Remember that power is altitude, an pitch is air speed. The only way to gain alti tude is with the engine running at max rpm The only way to gain air speed is by pitch ing the nose down.

When you’re near a stal or fighting your way out o a stalled condition, correc any wing-dropping tenden cies with the rudder—no the ailerons! To level th wings, add rudder in th direction of the high wing tip (Photo 2). This will yav the model toward the hig wing. This yawing momen tarily increases the air spee of the low wing and increases lift on the lov wingtip, causing it to rise.

If, instead, you were to apply full ailero to roll the plane level at this critica moment, you would probably throw th lower wing into a deep stall. The down ward-deflected aileron would add drag an further slow the lower wing, and ther would be no recovery at a low altitude.

ENGINE OUT ON CLIMB-OUT

If your engine quits on takeoff, try to glid straight ahead. Turning 180 degree depletes your air speed and usually result in a stall and a crash. If you can’t g

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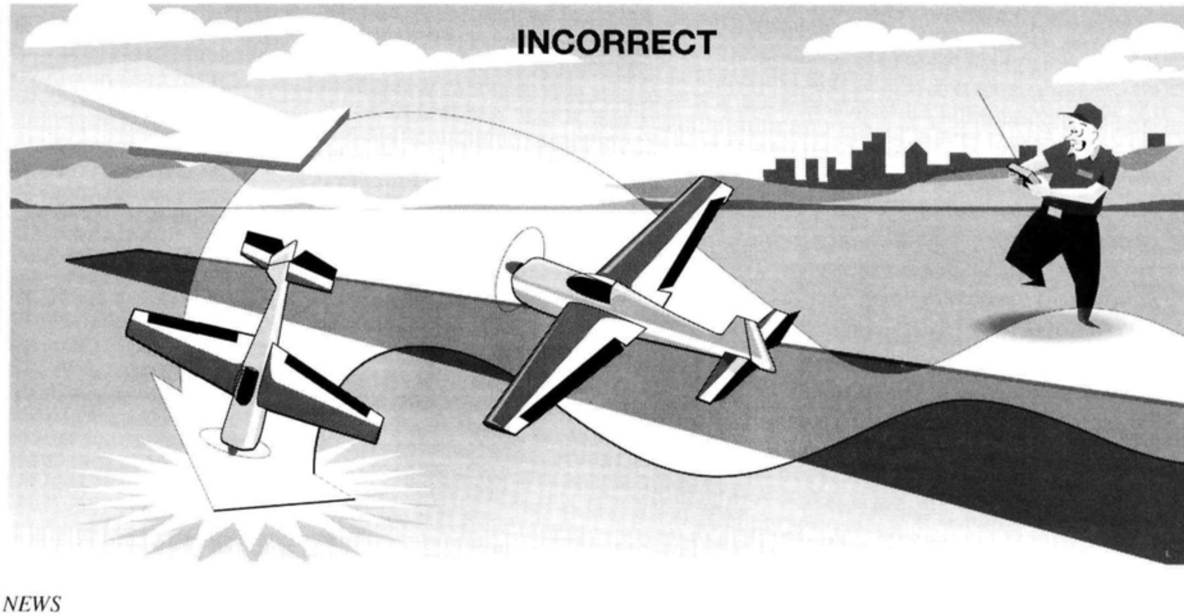


***Illustration 1.* Right-hand crosswind landing with the <u>incorrect</u> control inputs to recover from a high right-wingtip attitude. The added right aileron creates adverse yaw and the up-elevator slows the air speed. The plane stalls and crashes. (Note that the deflections are exaggerated for clarity.)**

Photo 1

Photo 2

Photo 3

1. Corrections for a stall on takeoff. Full power and a little down-elevator.

2. Corrections for a high, right wingtip on a right crosswind takeoff and climb-out.

3. Control inputs for a right-hand crosswind landing. Inputs are slightly exaggerated to show clarity of movement.

Author's note: the thumbs are placed off the tops of the sticks to allow better visualization of the stick movements.

straight ahead, then turn gently with your rudder, and push the nose down to gain air speed. Do not use the ailerons unless you need to slip the plane into a particular spot to avoid striking an object. If your engine starts to lean out on takeoff, reduce your power to about 75 percent, and keep your climb-out angle shallow by easing up on the elevator-stick pressure.

CROSSWIND TAKEOFFS

Crosswind takeoffs can cause crashes if the correct transmitter controls are not used. The guiding principle: to prevent the plane from flipping over, add aileron into the wind. Following full-scale practice, aileron input starts during the ground roll and decreases slightly as speed increases. Once the plane has taken off, rolling slightly into the wind directs the lift, generated by the wings, into the wind and counteracts the sideways drift of the model.

Wind velocity and ground speed determine how much you lower the upwind wingtip. If your ground speed is slow, you need more aileron into the wind. As ground speed increases, decrease the aileron input. If the crosswind velocity is high, you need more aileron input and, if there is just a gentle breeze, you need only a little.

Rudder is used to keep your model tracking straight and to counteract torque and the other factors that tend to swing a model's nose to the left during takeoff. If needed, you can "crab" into the wind after takeoff to ensure a straight track.

If, right after takeoff, the wind starts to flip your model over (the upwind wing starts rolling upward), follow the rules that apply in a near-stall or stall condition. Use your rudder to correct the bank angle: to roll level, input right rudder and relieve a little back pressure on the elevator stick, i.e., reduce up-elevator to pitch the nose down and regain air speed. Don't use the ailerons for bank correction when you're in this precarious situation.

PREFLIGHT CHECKLIST

Always check:

- engine and its mounting bolts;
- firewall mount;
- prop nut and muffler bolts;
- firewall attachment to the fuselage. Grab the plane by the prop, and hang the model in a vertical position. Sometimes, I gently shake the plane as an added check. It can ruin your day if the engine comes off the plane.

Examine the airframe.
Look for:

- stress cracks;
- proper landing-gear and wheel attachment. (I've seen many good aircraft lose wheels in flight and cartwheel on landing because of a wheelless landing-gear strut.)
- broken or loose hinges and linkages;
- proper attachment of the tail surfaces;
- proper wing attachment and strength. (A good way to check your wing's strength is to pick the model up by the wingtips. If the wing feels weak, it will never support the weight of an aircraft in a multi-G turn.)
- fuel-tank clunk and your fuel line and filter. (These can adversely affect your fuel intake. Pinholes or a loose fuel-filter housing can allow air to enter the fuel mixture and cause the engine to run lean.)
- CG placement (last, but by no means least).

LANDINGS

Too many R/C pilots land their airplanes improperly. The most common error is

ILLUSTRATION BY: DALE TREECE ©1995

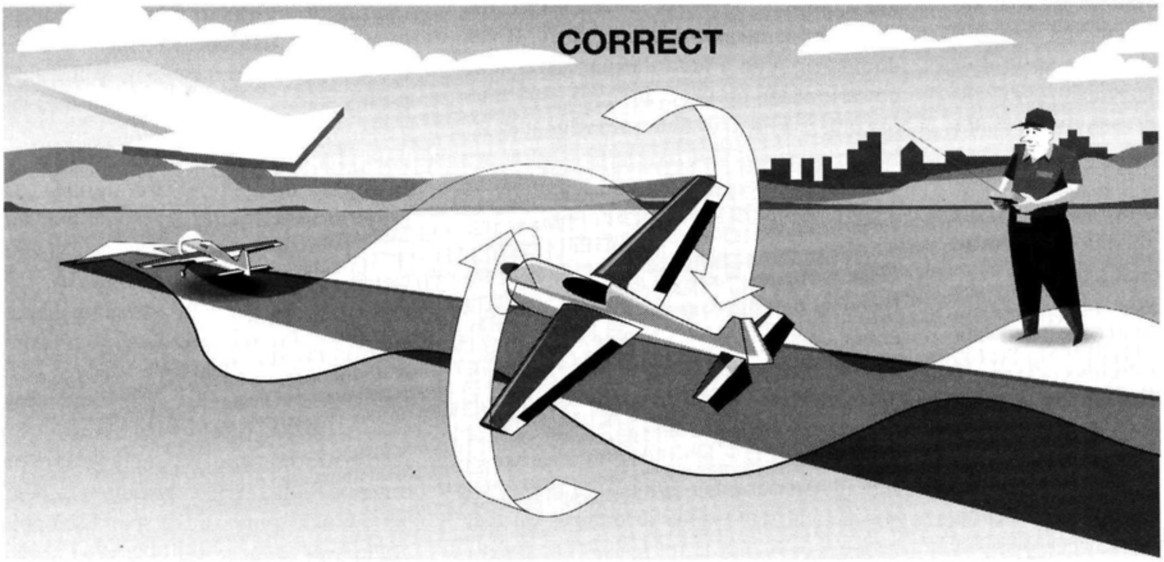


Illustration 2.

Right-hand crosswind landing with the correct control inputs to recover from a high right-wingtip attitude. Power is added, rudder is used to correct the high right-wing attitude, and the elevator is deflected down to gain some air speed. (Note that the deflections are exaggerated for clarity.)

ENGINE CHECK

Nothing spoils a flight more than an engine failure on takeoff. Always set your high end first, and check it by holding the model with its nose pointing straight up. It should hold max rpm with the nose high and change to a slightly richer mixture with the nose low. Adjusting your idle is very simple. Put your throttle setting on low, and see how the engine sounds. If it gurgles, sputters and quits, it's too rich. High rpm probably mean it's too lean. Check it by advancing the throttle rapidly. You should have a smooth transition with no burps or gurgles. On landing, if you need to do a go-around, you will want a reliable transition from idle to max power. Also, remember that an engine will lean out a little in the air, so don't set it for max rpm on the ground.

Air Density

A good engine run-up is essential for good performance. Make sure that you take into consideration the air temperature and the air density when you adjust your needle valve. On a cold day, the air is very dense (thick); therefore, there's more air per cubic foot, and your engine will need a richer setting. On a warm day, the air is less dense (much thinner) with less oxygen, and your engine will need more air (a leaner setting) to run well.

RADIO CHECK

- Secure battery leads and servo connections so that they won't come apart in the air.
- Check your receiver and transmitter batteries.
- Range-check the radio.
- Check the movement of the control surfaces for the correct response.
- Check your landing gear, if you have retracts.
- Listen for any servo noise or binding linkage movements. If the servos are not quiet with the transmitter sticks in neutral, you can be sure that you are drawing power from your battery.
- Make sure you have your frequency pin before you turn on your transmitter!
- Check trims, and don't forget to fully extend the transmitter antenna!

landing at too high a speed. Try to touch down with absolutely no bounce. To do this, slow the aircraft down during your landing-pattern setup. On the downwind leg, pull back the throttle, and add some up-trim to achieve a slightly nose-down, slow descent. The more throttle you take out, the more up-trim you must add. Sometimes, I pull back my throttle trim first and then use my main throttle stick to control my descent. This saves me from trying to find the throttle trim at that critical approach moment.

At this point, with your plane slowing down, it is best to turn the plane with the rudder and control the descent with the throttle. I always teach students to keep their left thumb on the stick and move both sticks in the same direction for better coordinated flight. Small input corrections are necessary at this time to keep the model on track. Too many planes have been dumped because pilots over-control on final approach. Try to keep your plane flying straight from final to touchdown. In full-scale flying, pilots track the final approach in line with the runway's center line. Just because you have a large landing area at your disposal, it doesn't mean that you can't practice precision approaches and landings.

Whether the wind is straight down or across the runway, you should anticipate corrective actions for a smooth landing. If the plane approaches the runway straight into a headwind, maintain a higher throttle setting to ensure that the plane reaches the field. You can also shorten up your downwind leg, base leg and final-approach pattern. Try to keep this question in mind: "If my engine quits now, can I make it to the field?" A strong wind will push you away, so keep the airplane closer to the field.

Once the plane is over the runway, let it come into ground effect and settle itself. Bleed off any excess air speed with minute up-elevator inputs. After touchdown, hold full up-elevator, and let the plane roll to a stop. Correct any directional problems with the rudder. If you touch down at the proper landing speed, you should have little or no bounce at all. If you do bounce with a hard impact, add a little power to keep up your air speed. Any kind of contact with the ground will diminish air speed. This will usually put the plane in a nose-high, low-air-speed configuration—a primary setup for a low-speed stall.

STALL RECOVERY DURING LANDING

If you do stall in this landing configuration—either on final or after a bounced touchdown—you must add power! Then add some down-elevator, and correct any wing-dropping tendencies with rudder. The stall after a bounced touchdown can lead to a cartwheel and all sorts of other gymnastics. How fast you are with these inputs determines whether your plane will live to fly again.

DEAD-STICK LANDINGS

Suppose your engine quits on the approach. Keep up your air speed by lowering the nose of the aircraft a little. Once you're sure that you can make it to the field, start to ease in some up-elevator to help you slow down. Then use the technique described above in "Landings" to complete your touchdown.

CROSSWIND LANDINGS

Always keep some aileron into the wind. As in crosswind takeoffs, air speed and wind velocity determine the amount of aileron input. In order to keep your ground track straight, counteract the rolling effect of the aileron input with some opposite rudder (Photo 3). This is called "cross controlling," and it puts you into a forward slip (the upwind, banked-down wingtip is yawed slightly forward), but it allows you to land without the plane flipping into a knife-edge attitude because of a wind gust underneath the upwind wing (Illustration 1).

If your plane does begin to flip (roll downwind) on the approach, add power to increase airflow over the tail surfaces, use your rudder to correct the banking of the wings, and add some down-elevator to keep your air speed up (Illustration 2). On the other hand, if you're set for a touchdown and the upwind wing starts to drop faster than you would like, add more opposite rudder and a little power. You can groove a beautiful crosswind landing with these inputs, but you must be quick and be able to anticipate what the plane will do.

PAY ATTENTION

Aside from using left-gimbal control inputs during problematic, low-speed, low-altitude situations, always use your eyes and ears to maintain your situational awareness. Don't fly with tunnel vision. Be aware of the other planes in the air. I've seen many crashes and near misses caused by someone not paying attention to what was going on around him. Call out your intentions to the others, and if you need help in the air, ask for it.

IN-FLIGHT EMERGENCIES

In-flight emergencies are another major cause of aircraft crashes. If you feel something is wrong, pull back the power immediately. Don't wait until the wing has flexed to the point of being two separate pieces. A reduction of power can save your airframe from an in-flight breakup.

UNUSUAL ATTITUDES

Aerobatic maneuvers, such as spins and inverted flight, frequently cause crashes. To get out of a spin or a flat spin, use opposite rudder to stop the model's rotation, then add

down-elevator to get the wing "un-stalled" and flying again. Next, gently ease in the power. After you have done all of this, make sure the wings are level, and pull back on the elevator stick to resume straight and level flight.

With inverted-flight recovery, you should remember two things: to get out of a tense situation, either push the elevator stick forward, or roll the plane right-side-up with aileron.

When a plane is flying directly toward you, move the transmitter sticks in the direction of the low wing. This will correct any unwanted bank angle and prevent your plane from flipping over.

Altitude can give you and your plane another chance. I can't stress enough the importance of practicing any kind of maneuver, recovery technique, etc., at a higher than normal altitude.

AIR DENSITY

Let's touch briefly on air density and aircraft performance. On cold days, your airplane will seem as if it can do anything. On hot days, it will seem as if it can't get out of its own way. Warm days cause more crashes because there is less air per cubic foot for the plane and propeller to bite into. Therefore, you must think ahead before attempting anything on a hot day. It takes your airplane a much longer time to recover from an unusual attitude on a hot day than on a cold day.

STAY FOCUSED

Depth perception is another problem that can result in a crash. When your plane gets too far away for you to tell its attitude, give it a command that your eyes will easily pick out, such as full up-elevator. Usually, a very abrupt attitude change can help you to determine whether you're coming or going or whether you're right-side up or upside-down. If you're close to the ground, tree backgrounds can fog up your attitude perception. If you can, stay above the tree line on your approach until your eyes can perceive the plane's attitude. Try not to make approaches with the setting sun as a backdrop. If you have no other choice, make sure you have a good pair of sunglasses that enable you to look near the sun and still see the plane coming toward you. If necessary, block the sun with your transmitter.

I hope these tips will help you keep your pride and joy in one piece. I've probably missed a thing or two, so please let me know if you have anything to add. I believe in promoting safety and pilot proficiency; the more we discuss and practice them, the better off we will all be. ■

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1995. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

HOLY SMOKE!

Sal Manganaro of Newtown, CT, says that he puts in from 800 to 900 logged R/C flights per year! A full-size Falcon Jet pilot, flight instructor and avid 30-year R/C modeler, he always finds the time to fly his latest creation—the Giant Stinger. This G-62-powered model is equipped with an electric, high-volume smoke system that rivals those of full-size show planes. The Stinger's equipped dry weight is 20 pounds, and its takeoff weight is increased by 3½ pounds when the fuel and the smoke oil are added. Nice bird, Sal!

BIG RED

This ⅙-scale 1940 Westland Whirlwind is equipped with homemade jack-screw retracts and custom-made fiberglass spinners and bombs, and it uses seven channels and 10 servos for all its functions. Jon Christenson of Windom, MN, scratch-built the 90-inch-span, 14-pound model following "Scale Aircraft Drawings, Volume II" (published by Air Age Inc.), and he powers it with two O.S. 70 4-strokes. Jon flies this giant with the Scale Flyers of Minnesota.

CLASSIC BIPE

Dave Friend of Prescott, AZ, sent this photo of his latest creation—the Bird Biplane. Built from *Model Airplane News* plans, the model has been modified for electric power; and, powered by an Astro 15 motor on 10 cells, it's a realistic flier. Dave flew and owned a full-size plane many years ago, but now he says, "At age 65, I don't miss the big ones and enjoy building and flying models more than ever."

BEAUTIFUL COLUMBIAN

This original design is the handiwork of Sean McHale of Summerland, B.C., Canada. The 64-inch-span, balsa-and-ply model has a balsa-sheeted foam wing, and it's covered with dope and silkspan and painted with K&B epoxy. Powered by an RJL .61, the model has good flight characteristics. Sean would like to thank the members of the Summerland Flyers, who have been very supportive in helping him learn to fly.

NORTHROP EXPERIMENTAL

Josh Spiers of Evesham, Worcestershire, England, scratch-built this 150-percent-enlarged Future Shock from *Model Airplane News* plans. The 16½-pound model has an 84-inch wingspan, and it's powered by a SuperTigre 3000 that's fitted with a ProSpark conversion to run on gasoline. To duplicate the Northrop's wings as closely as possible, he covered the model with Pro Film and then painted it with cellulose paint. Josh says, "Flying characteristics are, to say the least, superb. Hats off to designer Bill Evans."

PILOT PROJECTS

WHISTLING DIVE-BOMBER

Jorge Garza Perez Maldonado of Monterrey, Mexico, says that this JU 87D-5 Stuka flies very well and can perform exciting maneuvers such as snap rolls and Lomcevaks. He recently built the model from a Royal kit and decorated it with Du Pont paint. An O.S. FS-91 Surpass powers the Stuka in the many fun-fly and scale competitions held by the modelers in Monterrey.

AUSSIE WORKHORSE

Willie Gardner of Van Nuys, CA, scratch-built this ¼-scale model of a Transania Air Truk/Skyfarmer—an Australian plane that's used for carrying cargo, crop dusting and spraying and as an aerial ambulance. Powered by a SuperTigre 3000, the 117-inch-span model can lift 30 pounds. Willie covered the Skyfarmer with Dan Parsons glass and painted it with acrylic enamel, and he says that he spent close to four years on the project.

SCALE THUNDERBOLT

Dave Hock of Oakland, CA, plans to enter this Yellow Aircraft P-47 D25 in several scale contests this season. The model is covered with fiberglass cloth and epoxy, and Dave modified it for competition with a full, scratch-built cockpit, a Scale Specialties propeller and scale landing gear, doors, bomb racks and vents. Dave hand-painted his P-47 with water-based Polly-S paints and clearcoat. A SuperTigre 3000 provides plenty of power for the 21-pound, 80-inch-span plane.

PICTURE PERFECT

This deHavilland 89A Rapide belongs to Ivan Pettigrew of Chilliwack, B.C., Canada. He used his own plans to build the 77-inch-span, 7½-pound model, which he powers with twin 05 motors on 16 cells with a 2½:1 gear reduction. He can perform 20 "splash-and-go's" during each 10-minute flight. Ivan says, "Quiet electrics are the way to go for relaxed flying at a peaceful lakefront."

CANADIAN AT-6

Peter Dick of Chatham, Ontario, tells us that, in Canada, this plane is called a "Harvard Mk. 4." Built from the Midwest AT-6 kit, this ⅙-scale, 16-pound model has a silkspan-and-dope finish and is powered by a 1.08 O.S. 2-stroke. For scale realism, Peter added landing lights; wing, stab and rudder fillets; Robart air retracts; and an FTE dummy radial engine. The numbers, the roundels and the flag were airbrushed. This is the first plane that Peter has built in 47 years.

AIR SCOOP

by CHRIS CHIANELLI AND HIS LOYAL STAFF

EVERY APRIL, at the Toledo Show in Toledo, OH, hundreds of hobby manufacturers show their wares and announce new products for the coming year. Run by the Toledo Weak Signals Radio Control Club, this is the oldest major R/C airplane trade show in the country. *Here's a sample of just some of the exciting new products we saw at the latest show.*

Modeltech Sukhoi

The Modeltech* Sukhoi 60b.hp is a 61-inch-span, stand-off-scale rendition of the two-place SU-29. Over the years, Modeltech has gained popularity with modelers for its light, wooden ARFs that are assembled with great precision. The *SU-29 has been sanded and is virtually ready for final assembly* and covering. Its generous wing area and thick airfoil give a wide flight envelope that will please sport modelers. It features balsa and plywood construction and symmetrical, foam wing-cores that come sheeted.

SPECIFICATIONS

length—48 inches; wing area—644 square inches; engine required—.6 to .65 2-stroke or .60 to .90 4-stroke. List price—$340.99. Shown with the model and his awesomely powerful Russian-built SU-29 "super plane" is air-show flier John Piggott, president of John Piggott Air Shows, Lafayette, CA. John states, "High-energy aerobatics is entirely an individual accomplishment, where instant feedback is a reflection of your own capabilities. It is the ultimate way to sense personal achievement." Must be nice to self-actualize in an *ultimate machine like the SU-29, which is in a class of its own. For more information, call* (714) 963-0133; fax (714) 962-6452.

Autopilot with Video Link

Have you become consumed by the need to fly over-the-horizon, unmanned air vehicles (UAVs) with sophisticated electronics capabilities? The BTA Avionics System consists of three independent units that together create an "autonomous, multi-point guidance and navigation system" that incorporates "telemetry transmission of all essential platform features." In other words, you can see out the front of your model via a video link, and your PC/airplane link, using data from the global satellite positioning system (GPS), tells you exactly where your plane is and its attitude, speed, altitude, etc. Or you can buy just a component of the system, e.g., the BTA AS-05 three-axis gyro, automatic piloting system that stabilizes your airplane (with a true "fail-safe" capability). For more information, contact Condor R/C Specialties* at (714) 979-8948.

Robart Nose-Gear Robostrut

Robart* has added a fixed, steerable, nose-gear Robostrut (no. 654) to its line of functional Oleo struts. Designed for aircraft in the 6- to 14-pound range, it's a perfect match for the new Top Flite Cessna 182 Skylane. This new nose gear features functional Oleo action struts made of $\frac{3}{8}$-inch-diameter aircraft-steel tube; a hardened-steel steering tiller arm for positive ground control; a fork-yoke Oleo strut sized to *accept tires of up to 3 inches in* diameter; and a glass-filled nylon mount. It comes complete with all the necessary mounting hardware. Contact Robart at (708) 584-7616; fax (708) 584-3712.

Turbine-Powered Sport Jet

The Hot Flash is a turbine-powered sport jet that's custom designed, engineered and built by Terry Nitsch of Columbus, OH. It won first place, Best Finish.

SPECIFICATIONS

wingspan—66 inches; length—68 inches; weight—13.5 pounds; engine—JPX T-240 (distributed by BVM); fuel—liquid propane; speed—190 to 200mph. Features include flaps, retracts with nose-gear door, split-rudder braking system, E.D.M.-machined engine-mount system, brakes, Standox fluorescent paint, Sherwin Williams System 7000 clearcoat, Dry-Set graphics and markings, and ink panel lines with more than 8,000 rivets.

Saito 182TD Twin

Saito's* brand-new 182TD twin is based on a combination of two of their highly acclaimed 91S engines. The 182TD features dual carburetors, dual glow plugs in each cylinder and an integral cast-aluminum backplate motor mount. It weighs only 45 ounces with mufflers, and it turns a 15x8 prop at 10,000rpm—a welcome addition for the discriminating large-scale flier. Contact Horizon Hobby Distributors at (217) 355-9511; fax (217) 355-8734.

Race-Legal A-26 Invader

Dorian Anderson of Jet Hangar Hobbies* shows off the fuse of a new race-legal A-26 that Jet Hangar has developed for the giant-scale unlimited racing set. Call Larry Wolfe for details at (310) 493-1285. Larry also commented on his continued R&D on a new Turbax ducted-fan unit, which will surpass the performance of his current product. Contact Jet Hangar Hobbies at (310) 429-1244; fax (310) 429-6648.

Airtronics Blackhawk

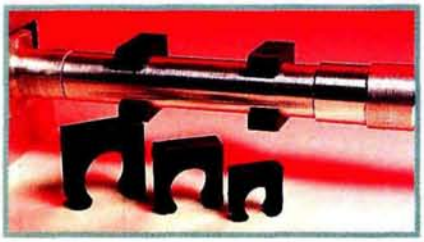
The Airtronics* Blackhawk was designed exclusively for thermal duration and F3J competition. It's the result of a unique blending of Dr. Michael Selig's design abilities, Competition Composites' aerospace manufacturing process, and the industry-standard quality of Airtronics kits. It's the ultimate high-tech sailplane.

SPECIFICATIONS
wingspan—113.5 inches; wing area—968 square inches; airfoil—S9000; flying weight—72 ounces.

The wings and stabs are constructed of impregnated carbon fiber in a CNC-machined tool, which gives the flying surfaces incredible strength and accuracy. Part number—ASD301; price—$999.95. Contact Airtronics at (714) 830-8769.

Sig's New Rossi Warranty

Sig Mfg. Co.*, sole distributor of Rossi engines in the U.S., now offers a three-year warranty on defects and workmanship. Sig is also the factory-authorized service center for the entire Rossi line. Engines shown: the 64R61 rear exhaust, pumped pattern .61; the 23R40Q Quickie Sport .40; and the 27R45 Blue Head .45. For more information, call Sig Mfg. at (515) 623-5154 or (800) 247-5008.



Century Jet Models Landing-Gear Door Brackets

At the '95 Toledo Show, Century Jet Models* introduced landing-gear door-mounting brackets made of super-tough nylon that snap onto wire or Oleo struts. These brackets make it easy to mount landing-gear doors or other scale items directly onto the strut and to permanently mount the doors or allow the use of 90-degree rotating struts. The brackets are available in 5/32- and 3/16-inch sizes for wire struts and 3/8-, 1/2-, 5/8- and 3/4-inch sizes for Oleo struts. Contact Century Jets Models at (502) 266-9234; fax (502) 266-9244.

Dynaflite PT-19

Dynaflite's* new kit—the PT-19—is a beautiful model of the prewar primary trainer (PT) that was used to teach some WW II pilots how to fly. It has a wingspan of 88.78 inches, a length of 69 inches, a wing area of 1,198.96 square inches, and its weight ranges from 11½ to 13 pounds. You can use a 1.20 4-stroke or larger, and the wing loading at 12 pounds is 23.05 ounces per square foot. Construction is all wood, and a two-piece plastic cowl comes with the kit. A one-piece plastic cowl can also be ordered from Dynaflite. Contact Dynaflite at (619) 744-9605; fax (619) 744-7923.

deHavilland Comet

How's this for a "golden age" favorite?!—the beautiful "Grosvenor House" hot-rod of the '30s: the deHavilland Comet. This is Bob Dively Model's* 88-inch-wingspan prototype Comet, which will be available soon. The kit, which should sell for around $395, is of all wood construction and has foam wing-cores. The Comet, which was designed for two .60 2-strokes or 4-stroke equivalents, will include: vacuum-formed canopy, cockpit interior and nose light and fiberglass cowls. Estimated weight is 16 to 18 pounds. What a beauty! For more information, call (216) 953-9254; fax (216) 953-9311.

Faye Stilley's "Le Viper"

When Faye Stilley was asked to count the pieces of MonoKote that he used on Le Viper, he stopped at 320, and that was just on the horizontal stabilizer. Faye, who placed second in the Top Flite-sponsored MonoKote covering contest and first in Pattern, used eight colors to cover the plane. The teeth, which were already glued in place in the cowl, were the most challenging. The fully functional cowl cools the engine through the dragon's nostrils, and the mouth acts as an air scoop to cool the tuned header. This is an excellent example of what time and patience can do for your model.

Pica/Robbe Dash-7 and Futura

Pica/Robbe* has two new products on the market. The multi-engine Dash-7 uses four Speed 400 electric motors that fly for 8 minutes on a single 7-cell Ni-Cd battery. The kit includes a molded, prefabricated superstructure; preformed pushrod access and servo mounts; injected, molded, motor-mount rings; connecting wiring; hardware and fittings; and instructions with pictures and decals. With its 6-foot wingspan, it can be hand-launched with ease.

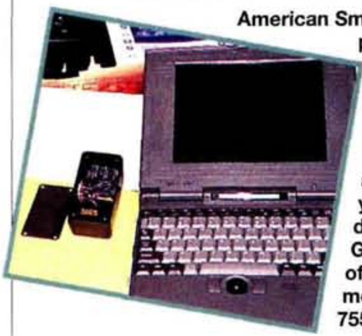
The Futura/Curtis Youngblood Signature Edition combines the talent of a great American pilot with German workmanship. Curtis Youngblood helped to design this do-it-all, high-performance FAI and 3D machine. Features include CNC-machined aluminum parts; ball bearings throughout; 24mm round tail boom; lightweight, flat gear; swashplate; drive pinion; autorotation hub; new, rigid drive system; single-piece, trimmed canopy; landing gear; and an aluminum frame. The rotor diameter is 58.7 inches, and the engine is a .61 2-stroke. It looks like a real winner. Contact Pica/Robbe at (305) 932-1575; fax (305) 937-2322.

Vailly Wulf

Roy Vaillancourt, president of Vailly Aviation*, is shown with his new Focke Wulf FW-190. Currently, only the plans are offered for $42, but the cowl, spinner, canopy and scale retracts will soon be available. Also coming are a fiberglass fuselage and a partial wooden kit.

SPECIFICATIONS wingspan—90.5 inches; area—1,305 square inches; engine—Zenoah 45 to 62, Quadra 42 to 50, or equivalent. For more information, call Vailly Aviation, (515) 732-4715 after 7 p.m. (EST).

Onboard Accelerometer



American Small Business Computers, Inc.*, producer of ModelCAD, has added a new product for the high-technology crowd—an onboard accelerometer that measures plus or minus G-forces to 25Gs and is accurate to 0.1G. After flying, you download the stored data to your PC. Display the G-forces in increments of time of your choice. Price—$199. For more information, call (918) 825-7555; fax (918) 825-6359.

Safety-Sealed Power Panel

Interesting things can happen when spilled fuel or a metal tool mingles with the components of an open-backed power panel. It happens all the time. The Super MOSFET design of Thunder Tiger's* new Power Monitor gives lower component running temperatures, and that allows the back to be totally sealed, so the circuitry is protected from external hazards. Like other panels, the Power Monitor has a 12V starter and pump capability, but it also features a glow driver that automatically adjusts to meet plug needs. For example: the Power Monitor will automatically boost the amps to start a flooded engine. List price—$49.95. For more information, call (214) 243-8238; fax (214) 243-8255.

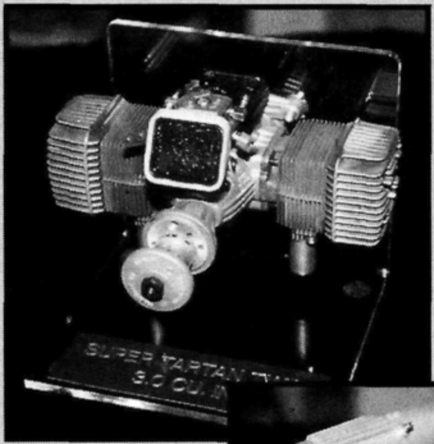
Scale Warbird Trainer

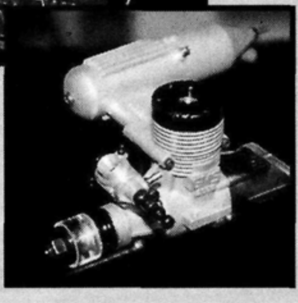
The T-28 is the newest addition to Byron's* line of warbirds. This smooth flying plane is powered by a Byron 3-blade power-prop system with a 4.2 engine, and from the tarmac to the top of the canopy measures 27 inches. Specifications: wingspan—96 inches; length—77.5 inches; weight—32 pounds. For more information, contact Byron at (712) 364-3165; fax (712) 364-3901.

True Turbines

The era of true model jets is coming; several manufacturers are conducting vigorous R&D. At Toledo, Tom Cook of Jet Model Products* showed off his Starfire II-C kit with installed SWB turbine. He will offer three sizes of the SWB powerplants (developed by Jeff Seymour) for use in his jet models. Announced were the SWB-3, producing 35 pounds of thrust, with a 5.75-inch outer diameter (slated for summer '95); the SWB-4, producing 20 pounds of thrust, with a 4.55-inch outer diameter (fall '95); and the SWB-5, producing 12 pounds of thrust, with a 4.13-inch outer diameter (for '96). Contact Jet Model Products at (816) 331-0356.

New Indy Engines





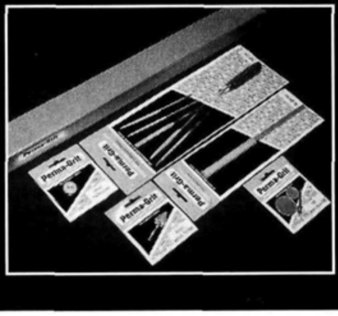
Indy R/C* is well-known for supplying American modelers with a diverse selection of high-quality model engines, among which are Zenoah ignition engines and ASP glow engines. Indy now offers the newest twin from Italia—the 3ci (50cc), 5.75hp Tartan. Like Indy, Tartan's name, too, is associated with high-quality performance engines. This new 50cc twin boasts a power increase of 37.3 percent (about 1hp) over the old Tartan 44cc model. The new Super Tartan will turn a 20x10 at 7,670rpm and a 20x8 at 8,500rpm. Also shown is Indy's new GMS 2000 .40/.47 ABC glow engine. The GMS 2000 series was designed from the ground up as a high-quality, high-performance line. Features include: two-piece button head with hemispherical combustion chamber; large crankshaft for better balance and strength; and large external reinforcement webbing for enhanced crankcase rigidity plus a new alloy not previously used in glow engine crankcases for superior strength. Contact Indy R/C at (317) 846-0766.

Freedom of the Frequencies

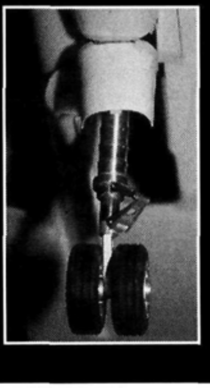
Never again, on those beautiful, but very busy, Sunday flying sessions will you have to wait an hour for the frequency pin. Designed to work with the Hitec* Prism 7 and RCD receiver, the Spectra Synthesized RF Module offers the freedom and flexibility to select an open frequency at a crowded flying site. Simply plug in Hitec's Spectra where the single-channel module usually goes, and you're ready to dial in any one of the 50 72MHz channels. It operates in both PPM and PCM modes. Spectra Synthesized module for Hitec and selected Futaba transmitter: list price—$199.95; set of four random receiver crystals—$39.95. Contact Hitec at (619) 258-4940; fax (619) 449-1002.

Better Tools and Runways

Bob Violett Models*, noted for leading the field in ducted-fan technology, has in the last year, acquired distribution rights to another line of superlative products—Perma-Grit tungsten-carbide hand and rotary tools. One of the newest products in the line is the aluminum-stock sanding block (the largest item shown in the photo). Imagine a sanding block that never wears out! You'll probably never go back to traditional sanding and abrading tools.



Bob also showed his newly released landing gear for his twin F-4 *Phantom* kit. BVM's efforts to expand the sport include donating ducted-fan kits to club raffles that raise money for the construction of asphalt runways (two to three sites selected each year). Whether or not you fly jets, hard-top runways provide more useful flying days than grass fields. If your club is interested in exploring such a program, contact Bob at BVM—(407) 327-6333.

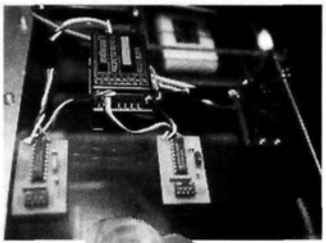


New Brushless Motor

At 7.5 ounces, the new Max 15 series brushless motor from MaxCim Motors* is said to be the lightest, most compact, brushless motor yet for R/C aircraft. The "Y" winding version accepts 10 to 20 cells, and the "D" winding accepts 6 to 16 cells. Both versions are listed at $175. Gearboxes with a choice of ratios are also offered. The 3-ounce controller (it's required) features a microprocessor setup and a BEC option, and it costs $135. MaxCim reports 10- to 14-minute flights with a Max 15 motor turning a Master Airscrew 12x8 electric series prop in a 5.3-pound Astro Flight* Porterfield Collegiate. For more information, call MaxCim Motors at (716) 662-5651.

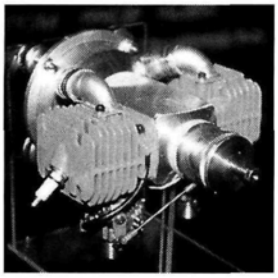
Precision-Scale Carbon-Fiber P51-D

Noted scale modeler Wayne Siewert, owner of Aerotech Models*, showed off this awesome, exact-scale, 84-inch-span, 21-pound P51-D kit designed around the Moki* 1.8 engine. The all-molded, hollow-shell, carbon-fiber construction includes aluminum spars and pre-hinged rudder and ailerons. More than 20,000 rivets, 400 Phillips-head screws and 100 slotted-head screws have been molded into the silver gelcoat surface of the fuselage, horizontal surfaces and one-piece, scale, laminar wing. Sequenced gear-door hardware, main gear (Century Jet*), wheels, tail wheel and much more come with the model, which, through July '95, is priced at $1,595.



Also shown here is the tiny Servo Slow by ICW Designs, offered through Aerotech. Four dip switches slow a servo's travel by up to 10 seconds at a time. Price—$37.95 (including S&H). Contact Aerotech at (612) 721-1285.

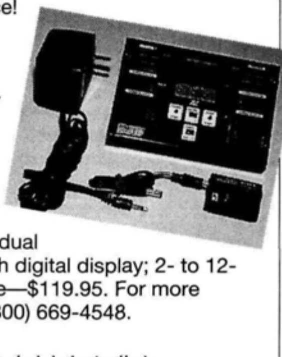
New Sachs Facts



According to Air Hobbies*, the new 5ci (80cc) Sachs-Dolmar twin will produce 38 pounds of thrust on an APC 21x12 at 8,200rpm while producing a low reading of 96 on the decibel meter. This is accomplished using the integrated stock muffler/mount system and isolation mounts. Other features include: electronic ignition, velocity stacks, smoke system and crankcase pressure tap. List price—$850. For more information, contact Air Hobbies at (704) 788-9042.

Ultra Tiny Receiver

DAD* (Design & Development Corp.) has a new receiver on the market—the ultra tiny Naked Micro 2000. It's capable of using up to eight FM channels. It measures 0.5x1x2 inches, and it weighs 0.5 ounce! A special circuit captures and rejects ignition and electric motor noise. Price—$79.95, including crystal.

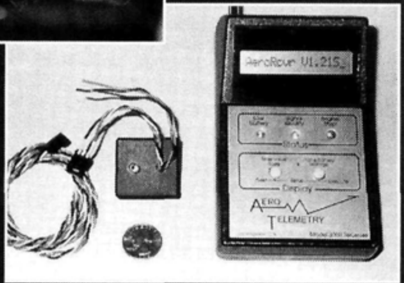


Right: DAD's Einstein—a greatly expanded dual charger/cycler with digital display; 2- to 12-cell capacity. Price—$119.95. For more information, call (800) 669-4548.

Micro-Size Downlink & Recovery Parachute

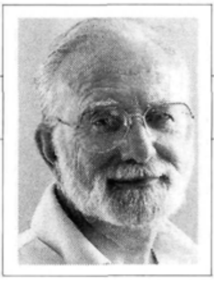
Aerotelemetry's new 14.5-ounce, $295 recovery parachute system can safely recover models weighing up to 78 pounds flying at speeds of up to 160mph. The possibilities for increasing safety while saving engines and even entire aircraft are intriguing. For more information, call (213) 746-9380.

Aerotelemetry's* new, short-range starter series, 3-channel, digital-data downlink can accurately measure engine rpm, air speed and battery voltages at ranges of up to 1/4 mile. This system, said to be the lightest and smallest data-telemetry transmitter package available, measures 1x1x3/4 inches and weighs less than 2 ounces. It draws less than 10mA of power from your flight pack. Shown above is the transmitter and the hand-held receiver (real-time LCD readout). Price—$498. Aren't these must-haves for the serious unlimited racing enthusiast?



*Addresses are listed alphabetically in the Index of Manufacturers on page 126.

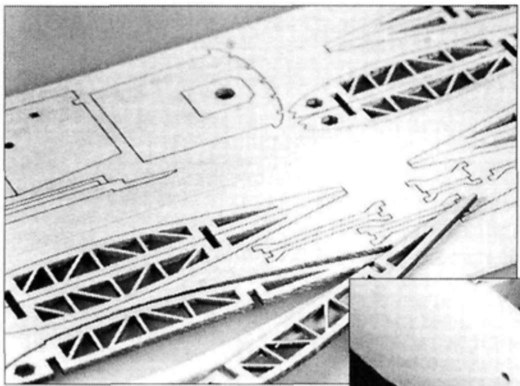
HOW TO:



RANDY RANDOLPH

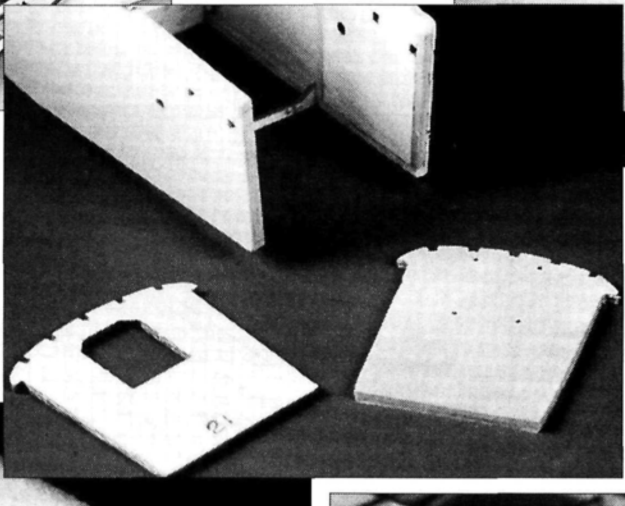
CONVERT A RUBBER-POWERED MODEL TO ½A GLOW

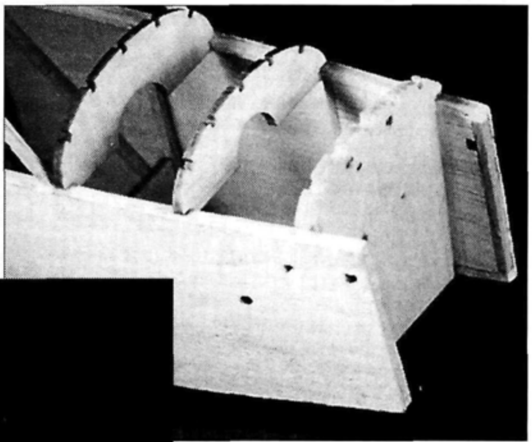
HERR ENGINEERING'S J-3 Cub and Ryan ST are some of the most innovative kits to come along in a while. All the balsa parts (there are a number of them in these kits) are laser cut, and they appear to have been machined, sanded and polished! Although these kits have been designed for rubber-powered free-flight, very little effort is required to convert them to 2-channel R/C, and the results are excellent. The photos show how to power the J-3 with a Cox* Pee Wee .02 and how to install the radio.*



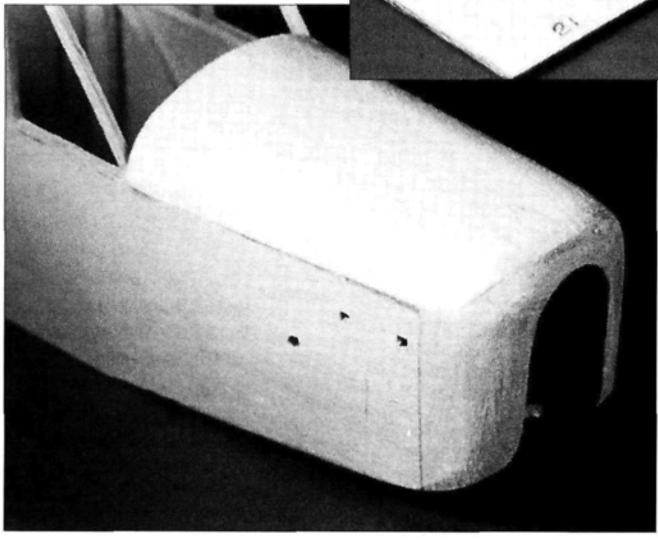
1 ***Above: this is an example of a laser-cut printed sheet; each part literally falls out of the sheet. The brown edges show where the laser has burned through the wood and left it ultra-smooth and true. The kit includes tissue covering material (more than is necessary), a propeller, rubber for power and associated hardware for the free-flying version.***

2 ***Below: for R/C flying, the fuselage will need a little beef, so build the sides according to plan, then sheet them with 1/32-inch medium balsa. Make the firewall out of 1/8-inch plywood, using former no. 21 as a template. I notched this one, but it isn't really necessary.***

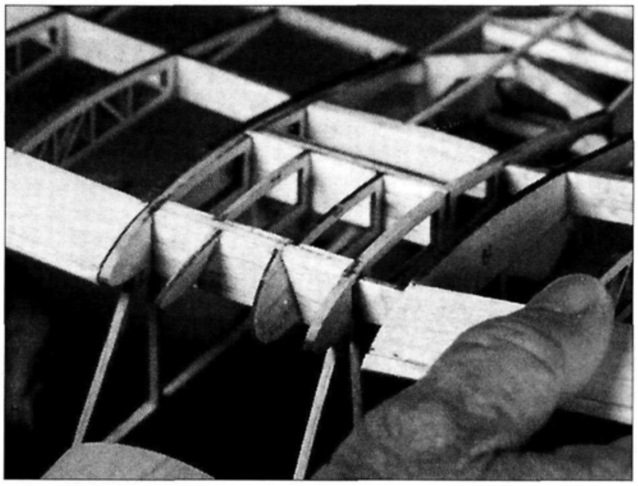




3 ***Epoxy the firewall 3/8 inch aft of the front of the fuselage sides. Build up the nose block using the parts provided and, after they've been sanded to shape, cut a 3/4-inch hole in the center of the thrust line. To eliminate weight and allow a generous amount of clearance for the engine, carve and hollow out the nose block as shown.***

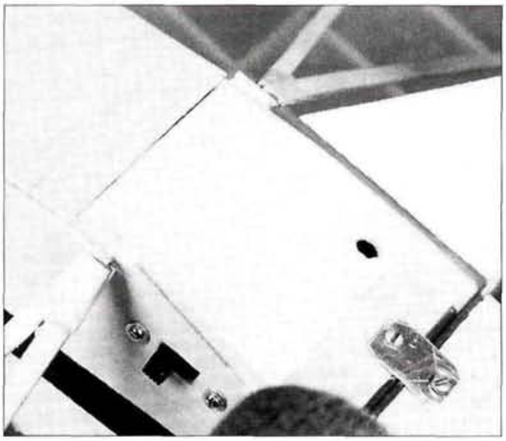


4 ***Glue the nose block to the front of the fuselage, and sheet the top and bottom with 1/16-inch balsa. When the sheeting has been completed, sand the cowl to its final shape. The three holes in either side of the fuselage are for positioning the built-up engine and its scale exhaust system, which is included in the kit—a very nice touch!***

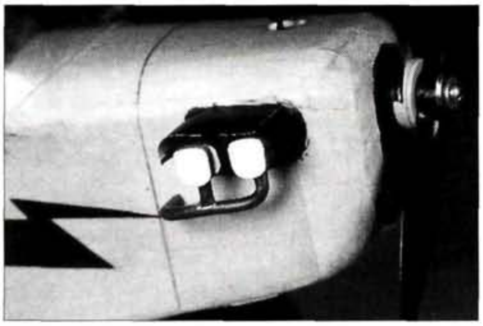


5 ***Follow the instructions for building the wing and the box structure that attaches the wings to the fuselage; this area is strong enough as built. Although the structure is intricate, the remarkably well-made parts result in a very accurate assembly.***

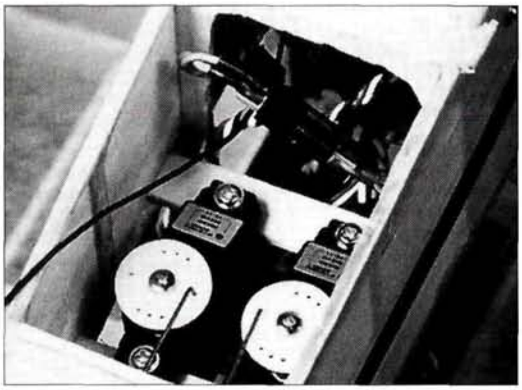
PHOTOS BY RANDY RANDOLPH



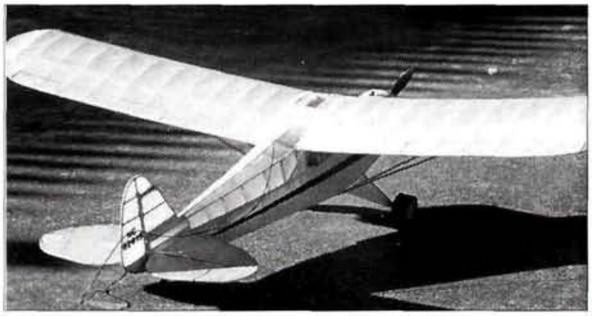
6 *The plans call for the landing gear to be sewed onto one of the fuselage bulkheads but, because this airplane will weigh more than twice as much as the rubber-powered version, a torsion-type gear should be installed. It adds practically no extra weight and withstands the landing loads much better. The scale shock absorbers were left off to allow the gear to flex on its own. Also visible in this picture is the radio switch and the hatch, which is just aft of the wing struts. The removable wing struts were made by gluing aluminum tubes to the wing and the fuselage at the strut joints. Wire glued to the wing struts hold the struts in place.*



7 *Once the airplane has been covered and doped, the engine is installed. Paint the inside of the cowl with thinned epoxy glue to protect it from spilled fuel and exhaust residue. The Pee Wee .02 is inverted on its mount, and a hole has been made in the top of the cowl for the needle valve and to allow access to the fuel tank. The engine can be installed through the opening in the front of the cowl.*



8 *The two microservos, which are mounted on plywood rails and glued to the center cabin longerons, are installed after the receiver and the 220mAh battery pack have been slipped through the hatch into the forward cabin area. The servos can be moved fore and aft to achieve the balance point shown on the plans. The antenna is routed through the aft fuselage just behind the wing and allowed to trail behind.*



9 *The tail surfaces, built as shown on the plans, are easy to hinge with a sewn figure-8 stitch. The elevator joiner is a 2-inch length of 1/32-inch wire that has been notched into the elevator's leading edge. Elevator and rudder throw shouldn't exceed 1/4 inch on each side of neutral. Because the wing loading is less than 7 ounces per square foot of area, flight performance is good. The J-3 takes off easily with a little forward stick; this gets the tail in the air before rotation. It climbs out very nicely and, like the full-scale Cub, aerobatics is limited. It sure does look great in the air! It's a beautiful kit and a lovely airplane.*

*Addresses are listed alphabetically in the Index of Manufacturers on page 126.

Exciting ideas for 42%-scale Formula One racing

A Formula for Fun!

by NICK ZIROLI SR.

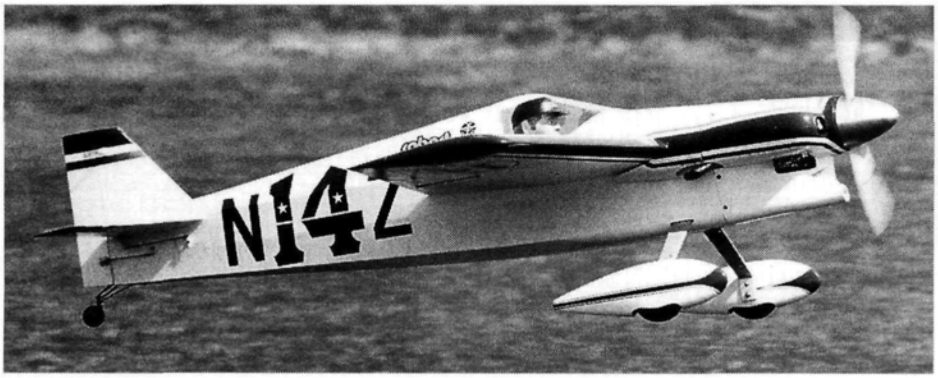
FULL-SCALE FORMULA One racing has existed in this country and abroad for almost 50 years. To be exact, August 1997 will mark the 50th anniversary of the first Formula One race. In the early years of racing, the planes were called "Goodyear Racers" because they were sponsored by the Goodyear Tire and Rubber Co. They became known as Formula One racers in 1968 and have retained the name ever since.

Whoever developed the rules and requirements for this class of racing must have known what they were doing; over the years, there has been little need for revision. The requirements specified: a minimum practical airframe around a stock 190ci, 85hp Continental engine with a fixed-pitch prop; a minimum wing area of 66 square feet and a minimum empty weight of 500 pounds; 2-wheel, fixed landing gear with brakes; and minimum visibility from the cockpit.

The only major rule change has been to replace the long-out-of-production 190ci engine with a 201ci, 100hp Continental. Top speeds have increased by about 100 mph: in 1947, Steve Whitman's "Buster" went 165mph; last year, it topped 260. Formula One racing has had its highs and lows in popularity over the years, but it's now enjoying great spectator interest.

AIRBORNE RACERS

Model airplane racing dates back almost as far as Formula One racing. On the West Coast, the First All Speed Team (FAST) club established rules for racing realistic control-line models in what was to become known as Team Racing. These models were not required to be scale, but they had to resemble a racing plane. What control-line flier of the '50s can't recall the "Key," "Quest," "Red Skin," or—one of my favorites—the F-86-like "Jezebel" of USMC Capt. Hank Bourgeois. Up to five .29-powered models were raced at a time in heats that were approximately 10 miles long. Short ½-mile drag races were also run. In those planes, fuel capacity was limited to 1 ounce. This meant that in long races, propping for maximum fuel economy was important to minimize pit stops. The short races required a compromise between acceleration and speed, and fuel economy wasn't a factor. Team Racing is still popular today. The models have become fast and fuel-efficient machines, but they no longer bear any resemblance to full-scale racers.


Nick Ziroli Sr.'s 42-percent Ole Tiger effortlessly breaks ground on its way to the racecourse. The 42-percent Formula One aircraft are perhaps the easiest to fly of all the giant-scale racers.


Nick and his framed-up fuselage. Lightweight, simple design and fixed gear all add up to a simple aircraft for racing.

R/C pylon racing started in the early '60s, again on the West Coast. The inventive Jerry Nelson spearheaded this activity, and it has been extremely popular in many classes. It originated with .40-powered, 450-square-inch wing area, scale Goodyear Racers. Brute power and clean aircraft lines have made these (until recently) the fastest model airplane racers.

Today, engine sizes of ½A, .049ci to 10ci (such as those on the new Unlimited Galveston and Madera Racers) are raced in pylon racing. The Quickie 500 has become the most popular pylon-racing event. Easy to build and maintain, the Quickies are simple, non-scale models that are very fast.

RACING RESOURCES

The Goodyear and Formula One Racers have always been favorites of mine. Many are beautiful designs that would make good models, but many are now outdated and unusable because of their aesthetics or aerodynamics. A reference book on all the Goodyear and Formula One Racers would be useful to those who are unfamiliar with racers such as a "Bonzo" or a "Rickey Rat," but I've yet to find such a book. If you know which kind of racer you want, contact Bob Hirsch, 8439 Dale St., Buena Park, CA 90620. Bob has close to 100, 11x17-inch sheets of 3-views. Other good

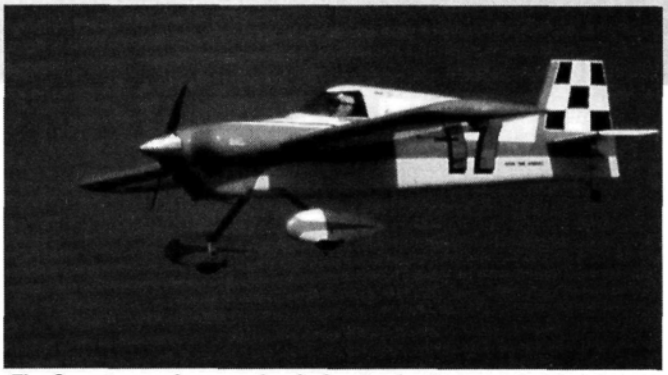
sources of information are model magazines from the '40s and '50s, when this kind of racing was very popular. *Air Progress* and other aviation publications also contain useful articles and 3-views of Goodyear Racers. Full-scale racing was very popular in these years, and it received a lot of attention in all sorts of aviation-oriented publications.

In the '60s, there was very little racing until 1964, when Bill Stead organized the Reno Air Races. The schedule included Goodyear racing, which was soon to become known as Formula One Racing. I have two 62-page, softcover books: "The National Air Racers in 3-Views, 1929-1949" and "The Modern Air Racers in 3-Views, 1949-1975," by Charles Mendenhall, who has written many aviation reference books. They show many 3-views of racing planes, including Goodyears. Another good source of Reno Race photos and interesting history (but not 3-views) is, "Gentlemen, You Have a Race"—a history of the Reno National Championship Air Races, 1964 to 1983.

RULES AND REGS

Given the huge success of the 100-inch-wingspan unlimited and 1/5-scale AT-6 pylon racers, it was only a matter of time before giant-scale Formula One would become a racing event. Formula One racing with 1/4-scale 4-stroke 1.20s has been popular in some parts of the country but has never gained national popularity. Endless Horizons (promoter of the Madera Air Races and the Long Beach Trade Show) saw the possibilities for a large-scale class in Formula One racing.

They established a set of rules that was later approved by the Giant Scale Racing Association (GSARA) regarding models that are 42 percent of full scale. A scale this large wouldn't be practical for any other class of racer except maybe Formula Five racers, which are about the same size as Formula Ones. This is a good size for this type of racing plane. Wingspans range from 6 to 10 feet, most being in the 80- to 95-inch range. Wing area can't be less than 1,675 square inches. Actually, 42 percent of full-scale (66 square feet) equals 1,676.5 square inches but, to make it easier to produce scale models, this number has been rounded down.

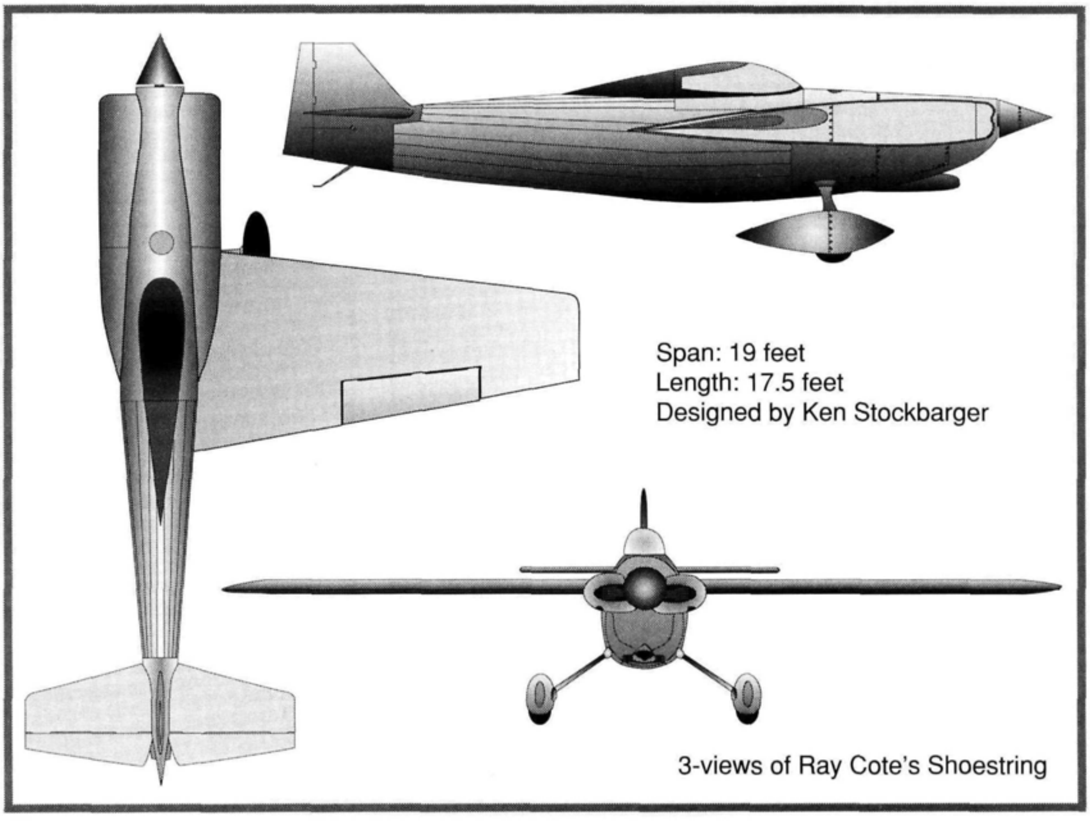


The Cassut racer is a popular design for the 42-percent-scale Formula One class. Here, no. 17 Phugawi built by Fred French lands after winning second place at the '94 Galveston, TX, race. Photo by Rob Wood.

GSARA has prepared model specification sheets on 44 Formula One racers. These are not 3-views, but they do contain all the basic minimum dimensions for many of the most desirable aircraft. Be very careful with the wing dimensions on some of these spec sheets; the span and chord measurements may not meet the 1,675-square-inch requirement and if they don't, the wing should be proportionally enlarged to meet this rule. Wing area is always measured to the center of the fuselage. No full-scale Formula One racer has flown with less than 66 square feet of wing area; no model should fly with less than 1,675 square inches. A copy of the book of spec sheets is available for $5 from GSARA, 1744 Greenwood Ave., Torrance, CA 90503. If you have a spec sheet that doesn't seem correct, contact GSARA for an updated one.

Top speeds have increased by about 100mph: in 1947, Steve Whitman's "Buster" went 165mph; last year, it topped 260.

Unlimited Scale Racing Association



3-views of Ray Cote's Shoestring

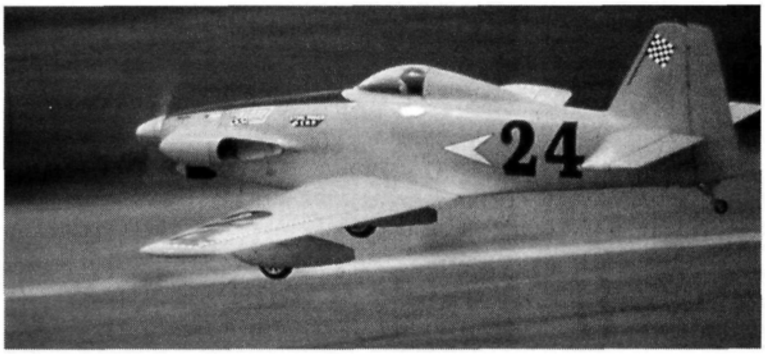
(USRA) has adopted basically the same Formula One rules as those prepared by GSARA for the Madera races, with a few major exceptions. The USRA-sanctioned races, such as Galveston, TX, are flown according to these modified rules.

The rules for Formula One Racing were designed to be easily enforced and to make designing a model simple. They also require that models be as true to scale as possible to ensure that they will maintain their scale appearance in the future. Experience has taught me that if racing rules aren't explicit, especially in the area of minimums and maximums, it can be difficult to make judgments within the rules. If there is a loophole in the rules, modelers will find it. Modelers can be very creative when it comes to interpreting rules.

GSARA president Dave Bridi shows off his new 42-percent Shoestring racer. Dave painted his Formula One model to resemble Ray Cote's famous no. 16 Circus Circus race plane.

IS BIGGER BETTER?

It was originally thought that because the full-scale Formula One class specified one engine make and size, it would be a good model class. But it's very difficult to enforce this rule because modelers learn all sorts of hard-to-detect hop-up tricks to get around it. To avoid the technical-inspection aggravation that this could cause (as it has done in AT-6 racing), it was decided to limit only the size. Unfortunately, the two racing organizations have chosen different maximum engine sizes: GSARA limits engines to a maximum of 4.6ci, and USRA set it at 6ci. Both organizations allow either gas or glow power, and neither allows tuned pipes of any kind; both allow engine modifications. Another variation pertains to wing thickness: GSARA allows a minimum of 13 percent on any wing with less than a 27-inch chord at the center of the fuselage, and 10 percent for wings with more than a 27-inch chord; USRA allows a minimum 10 percent on any plane. Both sides believe that their rules are correct. GSARA feels that larger engines and thinner wings will make airplanes that will compete at the 200mph speeds of the unlimited racers. USRA believes that 6ci engines are required to get the speeds significantly higher than the 120mph-plus speeds of the AT-6s.



Cosmic Wind is another design that is perfectly suited to 42-percent-scale racing.

I find it difficult to visualize a 42-percent Formula One coming close to 200mph when powered by an un-piped 6ci engine. These models are larger than any current racing class, and they have a lot of frontal area (including a 13-inch-wide cowl and fixed landing gear). Unlimited-class models are much cleaner and are powered by 12ci engines and larger tuned pipes. Some very high published Formula One speeds are not actually racing speeds; present racecourse speeds are pushing 150mph with a 6ci engine. At the '94 Galveston, TX, races, the fastest Formula One racer was Richard Oliver's "Ole Tiger" at 157mph. This model was powered by a highly modified 6ci engine. A number of 5.7, 5.8 and 6ci engines are available at fairly reasonable prices (as far as the big engine prices go). These are all from chainsaws and operate on spark or glow ignition, gas or alcohol and nitro fuel. I don't know of any readily available 4.6ci engines, but one very expensive bar-stock-type 4.6 racing engine has been announced.

There are 4.2 and 4.4ci

Editor's note: in light of the current discussion about Formula One rules, we gave Endless Horizons—promoter of the Madera Air Races in Madera, CA, and Hi-G Promotions Inc.—promoter of the Texas Air Races in Galveston, TX—an opportunity to comment on Nick Ziroli's suggested standards and to express their views on this debate.

Why Race This Summer in Texas?

- Over $26,000 in cash prizes.
- More racing—six or seven heats/pilot.
- Rules will be fair and consistently applied.
- Better qualifying—two-lap runs in groups of three. Each plane will have a timer. Cuts will be flagged, and there will be an opportunity to try again if fuel allows. Qualifying pilots will be able to fly again while the plane is running well.
- Better starts and fewer delays; "flying starts" based on 1-minute countdown clock.
- Trophy-race selection criteria. Total points from heat races will determine the top 15 planes in each class. Average times will be used to determine placement in Gold, Silver and Bronze races.

FYI—We support Nick Ziroli's comments and believe the 6.0 is a more suitable Formula One engine for the racing community.

—Hi-G Promotions Inc.

Madera and GSARA Respond

GSARA and Madera agree completely with Nick that rules should be standardized, not only for Formula One, but also for race numbers, other class sizes and for any other differences that directly affect the racers. Based on input and votes from their pilot's representatives, the board of GSARA approved the Madera Formula One standards and compromised on root and tip thickness. Last March, GSARA and Madera put considerable effort into a written proposal to USRA that asked for cooperation in standardizing rules, race numbers and other related issues, and suggested that the organizations work together as one. To date, USRA has not replied.

FYI—Twelve manufacturers have 4.2 to 4.6ci engines readily available. The top Formula One speed at Madera '94 was 142mph.

—Lesley Burnett, Endless Horizons

engines available from Quadra*, MAT* and other sources, but it is my opinion that an engine of this size—even a hot one—isn't suitable for a racing plane as large as these Formula One models.

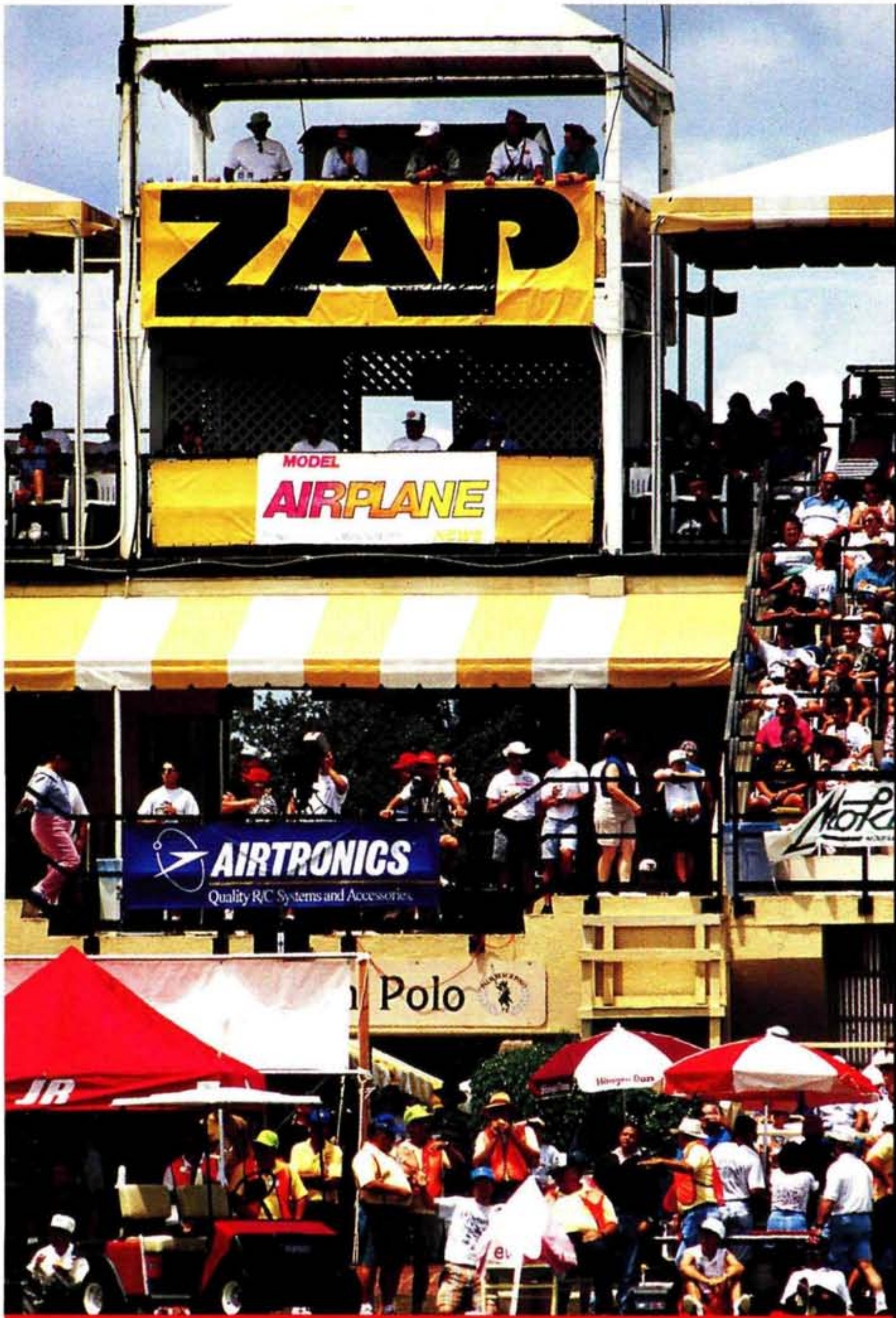
The differences I've mentioned will be a problem and should be addressed as soon as possible. To take full advantage of engine size, pilots will either have to build two sets of wings or have two engines available. They may choose to go to the trouble and expense that it takes to build and equip two airplanes. Neither option seems reasonable.

The simplest, most democratic solution is to let the pilots decide what they'd prefer to fly. Send a ballot to each Formula One pilot registered with GSARA and USRA (not just Pilot's Representatives) so that they can vote on this. Do this through a third party to reduce any questioning of the results. With this predicament out of the way, all models can be designed and built according to one set of rules. This should stimulate activity in this class.

I really do feel that this 42-percent Formula One class of racing could become the premier pylon-racing event. Spectators seem to like the largeness and realistic appearance of these models. They aren't very expensive or difficult to build (no more so than aerobatic models, such as the Extra or Cap). Powered by a 3.7 or 4.2ci engine, they are very attractive and excellent flying sport models. A growing number of plans and kits are becoming available, and that's a good sign of the potential for this class. If this class of scale racing does work and become as popular as it should, I would like to see it go one step further; it should include a class that requires you to design your own airplane. It would allow you to duplicate the work of a full-scale Formula One builder, but at 42 percent of the size. The rules would basically duplicate the full-scale rules, but with dimensional requirements of 42 percent of full size.

The old control-line Team Racers were designed along similar lines, which led to the production of some beautiful airplanes that could have been scale models. The creative designer could really exercise his pet aerodynamic theories and artistic talents (within the rules, of course). There is a future for the 42 percent Formula One class; that is, if there are common rules for all racing. There is enough interest to convince me that it will succeed and that, in time, one set of rules or the other will be used. Success will come more quickly if the rules are clarified now, and we can get on to designing, building and racing.

Addresses are listed alphabetically in the Index of Manufacturers on page 126.



First in Expert: Terry Nitsch; ⅛-scale F-86 Sabre Jet; 14 lb.; 58" span; BVM kit; foam/fiberglass; Zap CA and Z-Poxy; Coverite Presto metal finish with Ditzler acrylic enamel paint; BVM .91; Viojett fan unit; Powermaster JP-4 fuel; JR PCM 10SX; 9 channels with 13 servos; BVM retracts and tires with Glennis wheels; winner—'94 Top Gun and '94 Scale Masters.

TOP '95 GUN

SCALE SHOOTOUT

SPONSORED BY MODEL AIRPLANE NEWS & PACER TECHNOLOGY

by TOM ATWOOD & GERRY YARRISH

PHOTOS BY WALTER SIDAS, GERRY YARRISH, TOM ATWOOD & JIM ONORATO

WHEN WE ARRIVED early on Thursday morning at the West Palm Beach Polo Club, site of the '95 Top Gun Invitational, the excitement was thick in the air. Modelers from the U.S., Canada, South America and Europe were busily setting up their pit areas along a huge flight line hundreds of yards long. Gorgeous scale aircraft ranging from WW I fighters to modern jets were unloaded from vans and wagons as sun tents were pitched. This was truly a feast for the eyes, and it was only the beginning. Four days of scale competition at its very finest lay ahead—and a wide variety of exhilarating R/C exhibition flights. This remarkable scene unfolded under overcast skies that cleared only occasionally during the event. The infrequent showers did not dampen anyone's spirits, however, and static and flight competition was completed by Sunday as planned.

Second in Expert: Garland Hamilton; 1/6.5-scale F-80 Shooting Star; 18 lb.; 80" span; BVM kit; foam/fiberglass; BVM .91S; BVM Viojett fan unit; BVM special fuel; Airtronics Infinity; BVM retracts; second—'94 Top Gun Expert.

Above & right—third in Expert: Ramon Torres; 1/5-scale Cessna O-2A; 18.5 lb.; 91" span; all scratch; fiberglass and molded honeycomb composite; Zap; HobbyPoxy paint with K&B hardener; hand-painted markings; two O.S. .46 engines with 12x6 Rev-Up props; Texxon fuel; Futaba 9 PCM; 13 servos; scratch-built, geared electric retracts with sequencing gear doors; fifth—FAI '92 World Championships.

Fourth in Expert: Jeff Foley; 1/6-scale T-33A; 20 lb.; 85" span; Jet Model Products kit; fiberglass and foam; Zap; automotive primer and K&B epoxy paint; painted stars and stripes with smaller Dry-Set markings; O.S. .91; Dynamax fan unit; Sig fuel; JR PCM-10; 13 servos; JMP retracts; 5 lb. shaved off model's weight with lightening efforts, including built-up horizontal stab and control surfaces; vacuum-bagged gear doors.

Left & below—fifth in Expert: Nick Ziroli Jr.; 1/5-scale F6F-3 Grumman Hellcat; 48 lb.; 96" span; all scratch; fiberglass fuse, wooden wing and tail; automotive acrylic lacquer paint; painted markings and weathering; Sachs 5.2 gas engine; Zinger 24x14; Airtronics Vision, 6 channels; 7 servos; Robart retracts and tail wheel; custom-made tires. Pneumatic sliding canopy opens and closes with landing-gear operation.

Seventh in Expert: Corvin Miller; 1/4-scale Globe Swift; 21 lb.; 80" span; scratch-built; balsa and ply; Imron (same as full-size); Z-Poxy; hand-painted markings; O.S. 1.60 twin; Zinger 16x6/10; Pro Power; Airtronics Infinity 6-channel; 10 servos; scratch-built retracts; Vailly Aviation wheels; Robart tires.

Above—sixth in Expert: Kim Foster; 1/4-scale Sopwith Pup; 15 lb.; 80" span; Mike Reeves plans; balsa, pine and spruce; automotive lacquer over Sig Koverall; Zap; hand-painted markings; Laser 200; Zinger 18x8; Cool Power; Futaba 4-channel; 4 servos; cable control system; actual rib stitching. USA Scale team member—'92 to '94.

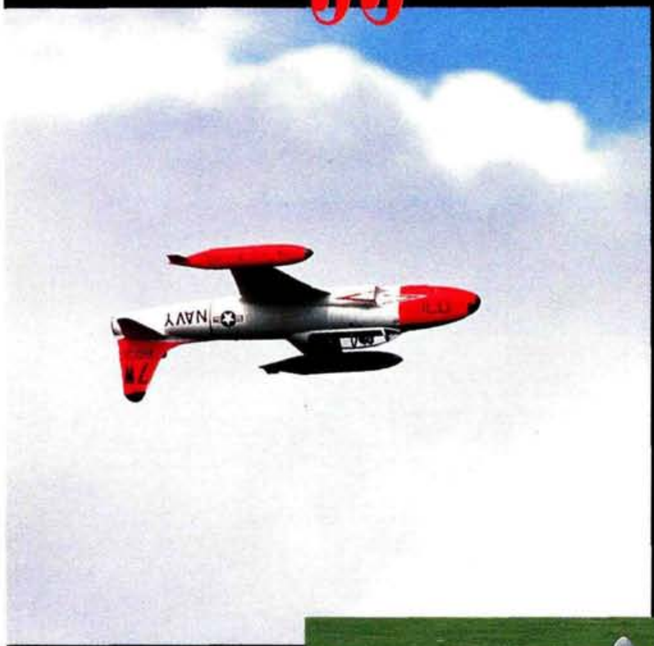
Eighth in Expert: Mike Barbee; 1/4-scale deHavilland 82 Tiger Moth; 16 lb.; 88" span; Duncan Hutson plans; balsa, spruce and ply; Delron base and clearcoat urethane over Supershrink Coverite; Zap; Dry-Set markings; Laser 150; APC 16x8; Cool Power; Futaba 1024 ZAP; 5 channels; 6 servos; operating LE slats; cable control system; Best Civilian—'94 Top Gun.

Ninth in Expert: Charlie Nelson; 2.8"/ft.-scale Waco VKS7F; 32lb.; 93" span; balsa, ply, fiberglass and aluminum; dope over Sig Koverall; Zap; Hand-painted markings; Seidel 7-cylinder radial; Zinger 22x10; Red Max; Airtronics Vision, 8 channels; 9 servos; flaps and retractable, wing-mounted landing lights; model was built around the dimensions of the Seidel engine.

Below—tenth in Expert: Stephan Durrstein; 1/9-scale Douglas DC-3; 29 lb.; 126" span; Fiber Classics kit; fiberglass fuse and wing, ply spar; epoxy base, automotive clear coat; airbrushed and computer-scanned markings; two O.S. .91 4-strokes; 3-blade 12.5x7; Red Max; Multiplex, 7 channels; 11 servos; Fiber Classics retracts with Kavan tires. Decals made with a PC to make color copies on decal paper.

TOP '95 GUN

Third in Team: Frank Tiano (right) and Ed Newman; ⅕.5-scale KI-61 Tony; 18 lb.; 86" span; balsa, ply and spruce; K&B primer and paint; Zap and Z-Poxy; hand-painted markings; O.S. 1.08; Zinger 14x8; Cool Power; Futaba; flaps; Platt retracts.



Right: first in Team: Bob Violett (right) and Jerry Caudle; ⅙.5-scale P-80 Shooting Star; 16 lb.; 80" span; BVM kit; foam; balsa and fiberglass; Coverite Presto with PPG acrylic paint; Zap; Dry-Set markings; BVM .91; Viojett fan unit; JP-4 fuel; JR, 10 channels; 12 servos; BVM retracts and wheels; lights; sliding canopy and split flaps; wheel brakes; speed brakes; tank drop.

Above — second in Team: Tony and Dave Malchione; ⅙.5-scale T-33 Thunderbird; 16.5 lb.; 80" span; BVM kit; epoxy paint; Zap; TAG markings; BVM .91; Viojett fan unit; JP-4 fuel; JR radio; BVM retracts and wheels; detailed cockpit.

Fourth in Team: Bob Fiorenze and Graeme Mears; ⅙.24-scale P-38 Lightning; 34 lb.; 100" span; Yellow Aircraft kit; Fiberglass; foam & balsa; Endura polyurethane; Zap; Chroma-Teck markings; 2 Moki 1.5 engines; Graupner 16x8 3-blade props; Byron fuel; Futaba 9ZAP, 8 channels; 10 servos; Fowler flaps; drop tanks; wheels; brakes; 4 separate pneumatic systems.

Fifth in Team: Steve Elias and Ian Richardson; 16.5-scale T-33 Thunderbird; 16.5 lb.; 80" span; BVM kit; fiberglass; foam and wood sheeting; Coverite Presto; epoxy paint; Zap; Dry-Set markings; BVM .91; Viojett fan unit; JP-4 fuel; Futaba 9ZAP; 10 servos; split flaps; BVM retracts; tires and brakes.

Sixth in Team: Jim Sandquist (shown here) and Jess Larson; ¼-scale Super Stearman; 45 lb.; 96" span; Bob Dively kit; balsa, ply, fiberglass, aluminum; Sig Koverall and Randolph dope; Bob Smith glue and Pica aliphatic resin; hand-painted markings; Brison/Sachs 4.2 gas; Clark 22x12; Futaba, 5 channels; 6 servos; Robart, fixed, shock-absorbing Oleo struts; Bennett smoke system; FTE dummy engine.

Thirty-fourth in Expert: Wayne Siewert; ⅕-scale KI-84 Frank; 32 lb.; 88" span; Aero Tech kit; carbon-fiber fuse; foam and balsa aluminum wing spar; acrylic lacquer automotive paint; industrial epoxy; hand-painted markings; Zenoah G-62; Zinger 20x8/14; Futaba; 7 servos; Century Jet retracts with Yellow Aircraft wheels; kit derived from Don Smith Plans; fully detailed aluminum cockpit.

Thirty-second in Expert: Skip Mast (right); 1⁄16-scale Lockheed HC-130H; 17 lb.; 97" span; scratch-built from own plans; balsa-covered foam; epoxy finishing resin, lacquer primer, epoxy paint; Zap; 4 K&B .21 engines; Master Airscrew 9x4; Airtronics; 7 servos; Zinger wheels; flaps; scratch-built retracts; strobe light; operating cargo door with cargo drop. Rivets and panel lines made with latex paint applied with old drafting pen.

Well over 13,000 people passed through the polo-ground gates during the event. Once again, primary sponsors were Pacer Technology, manufacturer of Zap glues and adhesives, and *Model Airplane News*. A host of contributing sponsors provided thousands of dollars in cash and prizes for the contestants. The people who really make Top Gun possible, of course, are the modelers themselves. The countless hours they have dedicated to the building, flying and perfecting of their master-level scale models and the creative genius they bring to the task, are ultimately what make Top Gun possible.

Seventeenth in Expert: Jim Wilkinson; 1/6-scale JU-87B Stuka; 21 lb.; 91" span; wood, fiberglass cowl and pants; acrylic enamel, Zap; airbrushed markings; Zenoah G-38 gas; Zinger 18x6/10; Futaba 7UAF; William Bros. wheels; landing lights; sliding canopy; dive brakes; bomb drop.

Above—twenty-fifth in Expert: Art Johnson; 1/6-scale North American P-82; 31 lb.; 102.5" span; all scratch; balsa, ply, aluminum tape finish; Zap; hand-painted markings; 2 O.S. 1.08 engines; Zinger 16x6; Byron sport fuel; Futaba 9 AUP; 18 servos; scratch retracts; William Bros. wheels; 4 wheels retract; 8 gear doors; 2 sequential inner doors; Art's fifth F-82 model. Above left: Ret. Col. Art Johnson's pitman starts the twin Mustang's powerplants. The F-82 model has independently controlled engines that were electronically coupled by Art's Futaba radio.

Right: Chris Burridge of Ontario, Canada, pulls his Zenoah G-38 through a few revolutions before firing up his Hawker Typhoon. Built from Chris's own plans, the British fighter weighs 22 lb.; 85" wingspan; scratch-built retracts and split flaps.

Left—twenty-first in Expert: Bob Underwood; 1/4.5-scale Hiperbipe home-built; 15¼ lb.; 73" span; all scratch; balsa, plywood; built-up wings; Coverite with Du Pont automotive enamel; Zap and aliphatic resin; painted markings; O.S. 1.60 twin cylinder; Zinger 18x6/10; Cool Power; Airtronics Vision, 4 channels; 5 servos; Du-Bro air-filled wheels; opening doors; Jerry Nelson flying wires; fourth Hiperbipe Bob has built.

Dave Platt (second from left) looks on as his 1/6-scale Grumman Mohawk is lifted into position for static judging; 23 lb.; 96" span; balsa, plywood—traditional building techniques; K&B fiberglass resin and Parson's 0.6 oz. fiberglass cloth, K&B epoxy paint; 2 O.S. .91 4-strokes; APC 14x6 props; Ace Pro 8000 radio; scratch-built retracts. Larger version of Dave's '94 Top Gun model. Winner—Best Military, Best Designer Scale and Critics Choice. Dave was an announcer at this year's event.

HEROIC RECOVERIES

Modelers are by nature problem solvers, and there was no shortage of resourcefulness and sportsmanship at Top Gun whenever a bit of adversity was encountered. Ray Labonte flew his gas-drinking, Enya V-240-powered, A6M5 Zero ably, but when he ran out of gas while on the wing, the ensuing dead-stick

The Team entry of John Tozser and Bill Fuori—this beautiful 1/4-scale 1930 Fleet Bipe—taxies into position for takeoff. Powered by a Quadra 42 gasoline engine, the Fleet has an 84 inch span and weighs 21lbs.

Kinner Replica Engine

The work of John Tozser (Stewart, FL) is an excellent example of the painstaking efforts and fine craftsmanship that are typical of Top Gun competitors. John's Team entry—a scratch-built 1/4 scale Fleet bipe—was piloted by Bill Fuori. This beauty was built of balsa, spruce and plywood following American Historical Society drawings. It's covered with Ceconite covering and painted with yellow and black butyrate dope.

Among other things, the plane features functional flying wires, adjustable-tension landing gear, full cockpit details and very authentic rib stitching. (John actually machined a pair of scissors to get the proper size "pinking" on the pinking tape used to cover the rib stitching). But the icing on the cake is an exquisitely crafted 5-cylinder dummy engine.

The engine is a miniature 90hp, 5-cylinder Kinner engine that John machined out of plastic, brass, aluminum and wood. The cooling fins on the cylinders, heads and manifolds were individually machined out of plastic. Valve covers are molded acrylic and the pushrod covers are small aluminum tubes. The heads and cylinders are held together with 00.90 bolts and nuts, and the intake and exhausts manifolds are attached to the head with 00.90 bolts. The five cylinders are set in silicone rubber to absorb vibration.

John doesn't know how many parts he used to make each cylinder, but he estimates that each cylinder took about 50 hours to complete!

—Jim Onorato

landing had an unfortunate outcome: the model was damaged and the wing broken into two large pieces. No matter: eight square feet of marine glass cloth, 16 ounces of Z-Poxy, and an afternoon-through-the-night's worth of labor later, the Zero was again flying. Nobody would have believed it, but Ray was back in the action. He finished 23rd in Expert.

Then there was Stephan Durrstein's hard-working crew from Mulheim, Germany. Last year, an inflight radio problem resulted in the demolition of their DC-3, stripping them of the chance to compete in flight competition. On their first flight this year, just after take-off, their new DC-3 wallowed in a near stall and had to be brought down before the cross-wind caused it to drift too close to the flight line. When it slammed down onto the grass, the landing gear and supporting structures were mauled. Stephan and crew worked through the night to repair the plane. Subsequent flights were good enough, in concert with static points, to give them 10th place in Expert. Job well done.

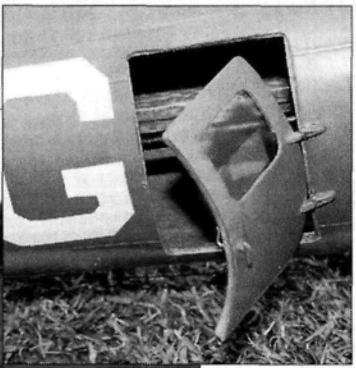
There were several other situations where pluck and an indomitable attitude prevailed over potentially harsh realities. David Platt, who lost a 1/7-scale Grumman Mohawk to a midair last year, this year lost his all-new 1/6 version when one engine died just as he entered a turn—this at the end of a slow speed pass—causing the plane to fall into a pond. Undaunted, Dave's chipper

Colombian Fortress

by JIM ONORATO

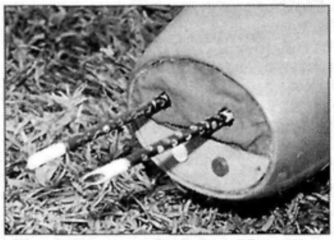
Luck wasn't smiling on the team of Ernesto Merlano (builder) and Carlos Forero (pilot) from Bogota, Colombia. About a month before Top Gun, the plane they planned to compete with—a Colombian Air Force troop transport similar to a C-130 Hercules—crashed on its first flight. Undaunted, they substituted an 18-year-old, 1/6-scale B-17 bomber powered by four O.S. 25s. The Flying Fortress, which was scratch-built from Tom Cook plans in 1977, has a wingspan of 79 inches and weighs 15 pounds.

The Colombian team (left to right) of C. Morell, Carlos Forero (pilot) and Jose Antonio Avila pose with their B-17 Flying Fortress. Powered by four O.S. .25 engines, the 18-year-old bomber has a 79-inch span and weighs 15 pounds.



All the access hatches are functional; this added much to the bomber's realism.

What makes this model so interesting? Its fuselage was carved out of a solid block of balsa that was cut in half and then hollowed out. All the interior features, including cockpit details and five hand-carved crew members, were installed in the halves before the pieces were glued back together. The rest of the model has a built-up balsa construction that's covered with silk and dope. They made the panel lines with MonoKote trim and hand-painted the markings.

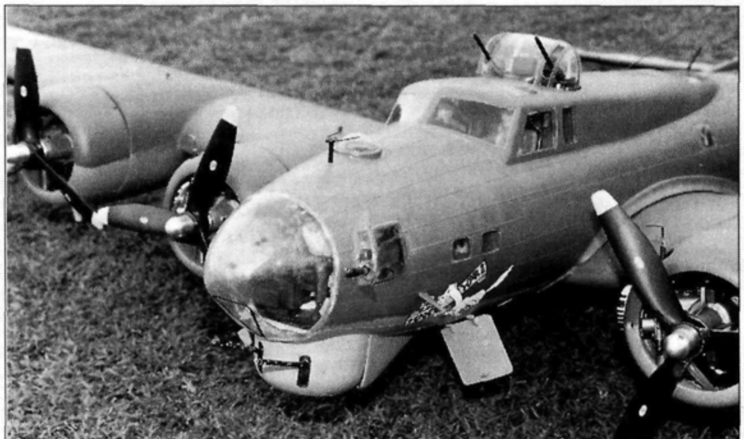


The tail gunner's twin .50-caliber machine guns.

An 8-channel JR radio guides the B-17, and in addition to the four traditional controls, it has Kraft electric retracts, split trailing-edge flaps, operating bomb-bay doors and eight bombs, navigation lights and turrets that rotate when the rudder is moved.

Its builder, Ernesto Merlano, did not make the trip to Top Gun owing to illness, but his absence spared him from the sight of his 18-year-old B-17 beauty disappearing behind the trees at the far end of the polo-club field during its first round of flight.

PHOTOS BY JIM ONORATO



Although smallish in comparison with the rest of the Top Gun entries, the B-17 was loaded with internal and external details, including functional hatches, electric retracts and machine guns.

TOP '95 GUN

voice continued over the PA system, and just minutes later, he cheerfully announced that the plane was repairable.

On the first day of the meet, Jim Sandquist struck a tree with his backup Red Baron Super Stearman show bipe. Later, while landing his primary plane, he could not reduce throttle below three quarters because of a broken stud bolt in the throttle linkage. He bit his lip and purposely nosed the plane over, breaking a prop and causing some damage to the rudder as the plane flipped. He immediately left the field, went to a hardware store, bought a larger replacement stud, drilled and tapped his engine and continued. He was able to complete all rounds of flying and, with teammate Jess Larson, earned a respectable sixth place in Team. There were many other such triumphs.

Below: this year, Top Gun official scorekeeper Rosella Curry used a new scoring packge: Simply Scale Scoromaster was created by experienced scale modeler and contest judge Cliff Tacie.

The Palm Beach Aeromodelers host Top Gun and take care of countless duties, from staffing the gates to arranging stations for judging. Thanks, fellas!

THE BEST OF THE BEST!

Expert

Pos.	Pilot	Plane	Static Score	Total
1	Terry Nitsch	F-86 Sabre Jet	96.500	191.583
2	Garland Hamilton	F-80 Shooting Star	96.083	189.916
3	Ramon Torres	Cessna 0-2A	95.917	189.584
4	Jeff Foley	T-33A	95.500	289.500
5	Nick Ziroli Jr.	F6F-3 Hellcat	95.583	198.208
6	Kim Foster	Sopwith Pup	96.750	188.583
7	Corvin Miller	Globe Swift	96.583	187.666
8	Mike Barbee	DH-82 Tigermoth	95.833	187.625
9	Charles Nelson	Waco VKS7F	95.833	187.625
10	Stephan Durrstein	DC-3	95.250	187.125

Team Scale

1	Bob Violett/Jerry Caudle	P-80 Shooting Star	93.833	186.791
2	Dave/Tony Malchione	T-33 Thunderbird	93.500	183.917
3	Frank Tiano/Ed Newman	KI-61 Tony	92.250	183.167
4	Bob Fiorenze/Graeme Mears	P-38 Lightning	91.250	182.333
5	Steve Elias/Ian Richardson	T-33 Thunderbird	89.833	182.041

Special Awards

Award	Sponsor	Pilot	Model
Best Graphics & Markings	Aeroloft Design	Jim Sandquist & Jess Larsen	Super Stearman
Best Multi-Engine Model	M.A.T	Art Johnson	F-82
Best Designer Scale Entry	Scale Model Research	Dave Platt	Mohawk
Best Biplane	R/C Report	Mike Barbee	DH 82 Tiger Moth
Best Civilian Aircraft	Top Flite	Corvin Miller	Globe Swift
Best Military Aircraft	SuperTigre	Dave Platt	Mohawk
Best Craftsmanship	Dry-Set	Sepp Uberlacher	Hawker Tempest
Best Jet	Bob Violett Models	Ralf Ploenes	F-80
Engineering Excellence	Robart Mfg	Bob Karlsson	Wildcat
High Static Score/Expert	Glenn Torrance Models	Sepp Uberlacher	Hawker Tempest
High Static Score/Team	Boca Bearings	Jerry Caudle	P-80
Critics Choice	Airtronics & Van Dell Jewelers	Dave Platt	Mohawk
Top Buns Award	Top Gun Hussies	Pat McCurry	

Performance Awards

Best Gas Engine	Precision Eagle	Nick Ziroli Jr.	Hellcat
Best 2-Stroke	Gerard Enterprises	Ed Newman	KI-61 Tony
Best 4-Stroke	Saito Engines	Alvin Brown	DC-3
Best Aerobatic	Midwest Model Products	Steve Elias	T-33

EXHIBITION FLIGHTS

The exhibition flights were supreme examples of seemingly effortless aerial ballet; words fail us to describe the beauty of these virtuosic demonstrations. Geoff Combs flew his 44-percent Extra 300S (the plane he campaigned at last year's Tournament of Champions) to the awe and amazement of thousands of spectators. How big is this plane? Its propeller is a Menz 30x12! The 3,060 squares on his 49-pound Extra were an eyeful, and his performance lived up to his TOC stature. Florida state R/C aerobatic champ Ken Fidler pulled out all the stops with his Carden Aircraft Extra 300: rolling circle on takeoff, hover to torque rolls, rolling Cuban-8s, square knife-edge loops; he's the ultimate showman. Jason Schulman and Chip Hyde offered similar aerobatic performances. It just doesn't get much better.

Bubba Spivey and Wayne Voyles flew their Lanier Stingers in a beautiful, paired, aerial dance. In their opening, with smoke spewing from both Stingers, one entered a flat spin and the other circled around it. Their planes majestically circumscribed the sky in a grand descent from on high. Terry Nitsch and Bob Violett each flew eye-opening demonstration flights with the BVM Maverick Pro, and Jim Florio of Florio Flyer showed the crowd some mad antics with his QuickDraw. Don Muddiman amazed the crowd with the high-G maneuvers of his Flying Machine, and Dave Platt and John Ramsdon demonstrated how U-control combat is flown. The biggest crowd pleaser may have been the demonstration of combat flying by the West Palm Beach Aeromodelers. They flew Small Wildthing kits from Quality Aircraft in a buzzing combat performance that was reminiscent of a swarm of mosquitoes.

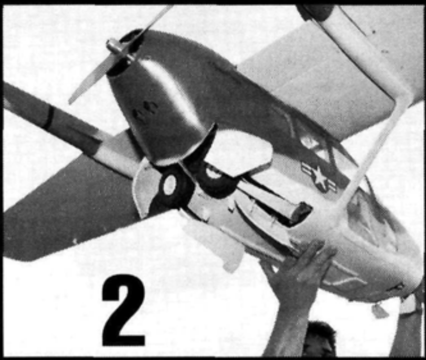
The master himself, Dave Platt, spent countless hours researching, designing and building the scale landing gear for his Grumman Mohawk. Can you tell the model from the real thing?

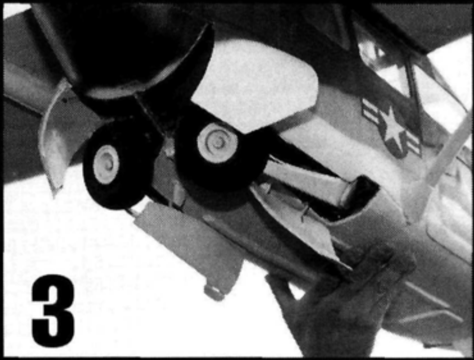
Bob Karlsson's F3F Wildcat would surely win the "Aircraft with the narrowest landing-gear-stance" award (if one were ever awarded). Bob's masterful engineering earned him the prestigious Engineering Excellence award; folding geometry at its finest!

Retractable Treasures

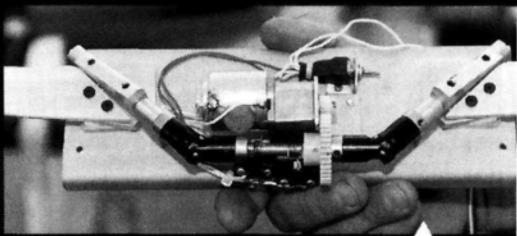
by GERRY YARRISH

For most of the competitors at Top Gun, scale fidelity doesn't end at the bottom surface of their model's wing. Functional, scale, retractable landing gear is the rule and not the exception. But you wouldn't find Bob Karlsson's F3F Wildcat's belly-mounted landing gear or those supporting Dave Platt's Mohawk at your local hobby shop! Here's a brief, up-close look at just some of the fantastic landing gear at this year's event.



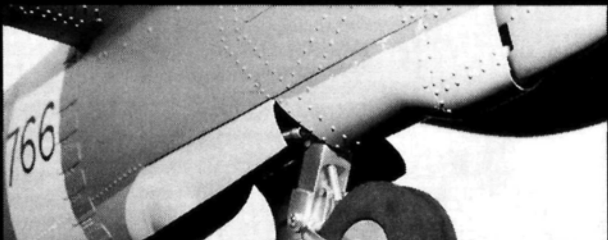


Ramon Torres' Cessna O-2A has a rearward-retracting main landing gear with sequencing landing-gear doors. This fascinating, functional design looks deceptively simple.



Here's Ramon's drive mechanism for his Cessna landing gear. The electric drive motor is controlled with microswitches, and universal joints drive and lock the gear up and down. The entire unit is mounted on a removable aluminum plate.

Winner of High Static and Best Craftsmanship, Sepp Uberlacher of Ontario, Canada, blew everyone's mind with his handcrafted Hawker Tempest landing gear, which was functional in design and dimensions. Sepp's awards were well-earned!



Sepp also duplicated the complicated, intricate tail-wheel retract mechanism and its landing-gear-door linkage—no small task !

TOP GUN '95

Other notable exhibition flights were those by Jim Dunn, whose gentle aerobatics in a full-scale Pitts S1 accompanied the National Anthem at the start of every day.

THANKS!!

We thank all of the many sponsors and others who contributed to the event. Specifically, we owe thanks to Pacer Technology and Frank Tiano Enterprises, the Palm Beach Aeromodelers, Dave Platt and Rich Uravitch, who ably served as announcers, the many contributing sponsors, the flight and static judges, chief judge George Leu, and last, but not least, to all the scale modelers who worked so hard to create the aircraft that are the core of this prestigious contest.

There are a few major events in R/C modeling whose drama and spectacle stand out above the rest. Top Gun is such an event in the scale world. See if you can find the time to attend next year's Top Gun. You'll find it unforgettable and well worth your while. ■

The Scale Within

by GERRY YARRISH

At Top Gun '95, master modeler and scale designer Dave Platt came back with a larger version of his ill-fated '94 TG entry—a Grumman Mohawk. Just as impressive as his last one and even bigger than it, the new Mohawk's detail is incredible, both inside and out. Those who looked closely at the model were treated to exquisitely rendered details such as a fire extinguisher, detailed instrument panel, pilot and copilot seats, and—on the aft cockpit bulkhead—a sound-damping, bulletproof "quilting." Here's how Dave made this cockpit quilting.

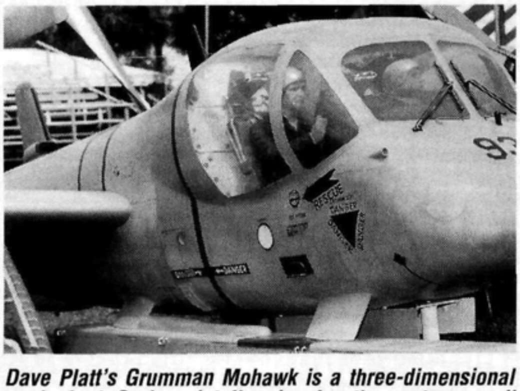
1. With a rolling pin, Dave flattened a piece of Plasticine (modeling clay) to a uniform thickness of about 1/16 inch. He rolled it until he had a piece that was about 1 foot square.

2. The lines of "stitching" are about 3/16 inch apart, so he repeatedly pressed the edge of a ruler into the Plasticine to make lines of "stitching" at this interval.

3. To make a diamond pattern, Dave pressed the ruler into the Plasticine again, cutting through his first lines at the appropriate angle.

4. Next, Dave erected a balsa frame dam around the Plasticine sheet, poured polyester resin over the Plasticine and allowed it to cure overnight.

5. When the resin had cured, Dave simply peeled the Plasticine away from it, and he had a resin mold. (Plasticene doesn't require the use of a releasing agent.)



Dave Platt's Grumman Mohawk is a three-dimensional work of art. Surface detail, color, functions, etc., are all as they should be to duplicate the full-size aircraft. Inside the cockpit is no exception; from floors to bulkheads, the look is scale.

PHOTOS BY GERRY YARRISH

6. Next, he sprayed a few coats of PVA mold release onto the resin mold and allowed it to dry.

7. Finally, he poured polyester resin onto the mold and allowed it to cure; then he removed the resin sheet and cut it to the shapes he needed for his Mohawk.

As you'll see in the photos of Dave's finished model, the "quilting" is applied to the bulkhead in panels that are cut to shape and then screwed into place. Make the piping around the panels out of servo hook-up wire, soft electrical solder, etc. Dave sprayed his quilting with light gray paint and screwed it into place with small servo-mounting screws. They look just like the screws and large washers used in the full-size Mohawk. A light coat of Burnt Sienna dulls the screws' shine.

Small details enhance any scale model. Look at your subject aircraft and see what covers its bulkheads. It's a sure thing that you won't see painted balsa or plywood!

Sponsors

- *Model Airplane News*—prize money, judges' travel, shirts, trophies.
- Pacer Technology—prize money, judges' travel, hats, trophies.
- Aeroplane Works—kit for pilot raffle.
- Aeroloft Design—$200 gift certificate, Best Graphics and Markings.
- Air Flare—Sundancer kits, assorted prizes.
- Airtronics—Infinity 660 radio, Critics' Choice.
- Bob Violett Models—$500 gift certificate, trophy Best Jet.
- Boca Bearings—$200 cash, trophy High Static Team Scale.
- Dave Platt Models—retractable landing gear, 3rd place Expert.
- Dry-Set Markings—$200 cash, $200 gift certificate, Best Craftsmanship.
- Eagle Editions—5 art prints, Expert and Team prizes.
- Frank Tiano Enterprises—books, raffle prizes, gifts, cash, trophies.
- Futaba Inc.—7-channel radio, 1st place Team Scale.
- Glen Torrance Models—$200 cash, trophy High Static Expert.
- Herr Engineering—trophies for mass rubber-powered launch, 200 glider kits.
- Hitec Radios—6-channel radio and servo pack, 2nd place Expert.
- JR Remote Control—7-channel radio, 1st place Expert.
- Lanier RC—Stinger kits and assorted prizes.
- Madden Model Products—100-inch KI-61 Tony kit, 2nd Team.
- McDaniel R/C—Ni-starter and on-board glow driver, Best Multi-Engine Performance.
- Midwest Model Products—Extra 300 kit, trophy Best Aerobatic Performance.
- Model Aviation Technology—$200 gift certificate, trophy Best Multi-Engine Performance.
- Moki-Gerard Enterprises—Moki .61 engine, Best 2-Stroke Performance.
- Precision Eagle—Eagle 4.2 gas engine, Best Gas-Engine Performance.
- R/C Report—$200 cash, trophy Best Biplane.
- Robart Mfg.—$500 gift certificate, Engineering Excellence award.
- Saito Engines—Saito 1.50, Best 4-Stroke Engine Performance.
- Scale Model Research—$200 gift certificate, trophy Best Military entry.
- SuperTigre Engines—S.T. 4500 engine, trophy Best Civilian entry.
- Top Flite Models—Cessna 182 kit, assorted trophies.
- Van Dell Jeweler—Critics' Choice award.
- Top Gun Hussies—custom wheels and tire set, trophy Top Buns award.

FIELD & BENCH REVIEW

A good-lookin', IMAA-legal, scale classic with flaps

TOP FLITE *Cessna 182 Skylane*

by JIM SIMPSON

AS A FULL-SIZE aircraft pilot, if I had to make do with only one of the many aircraft I have flown, it would undoubtedly be the Cessna 182 Skylane. It's simple and easy to maintain, and it's powerful and stable. Here in the Rocky Mountains, these are highly prized traits, so it's easy to find 182s at the many local airports.

I was sorely tempted to make this project a true scale model of one of the several aircraft located at an airport near my home. Time and integrity precluded me from doing so. After all, if I made the necessary changes, it would be kit-bashing (not reviewing) and, as is, the Top Flite* Cessna 182 is a great sport-scale project, so what you see here is what you get.

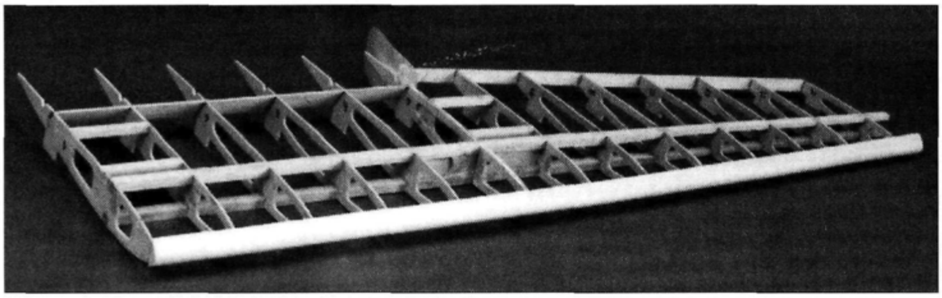
Associate editor Roger Post checks the flight controls while Craig holds the plane.

CONSTRUCTION NOTES

Keep the box-top photos close by as you build this model; they're a big help. The plans are well-organized and easy to cut into workable strips. I always follow the instruction manual when

reviewing a kit. Even though I've been building R/C models since 1953, I almost always learn better ways to do a particular task, and this kit was no exception.

It's obvious that this model is intended for more experienced modelers, but the manual is so well-written and the sequence so logical that a less-experienced modeler might also do well. The manual advises those with less experience to seek knowledgeable help with the assembly and the first flights.



Bottom of right wing panel. After you sheet this, flip it over and cut off the tabs on the ribs. The tabs help you build in the proper washout.

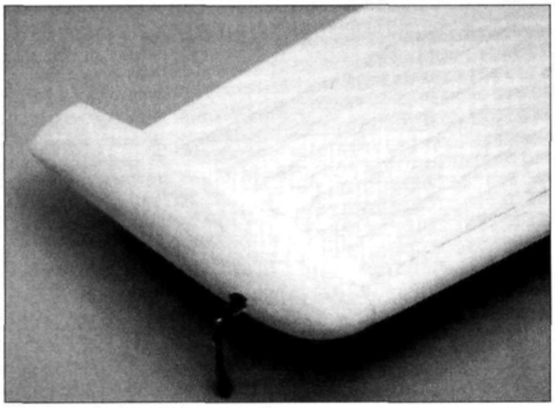
Read the entire manual before you start. You'll discover that a lot of planning is required at the outset. Even though a 4-stroke would sound much better, I chose an O.S.* 1.08 2-stroke engine, because it's the largest engine that fits without having to cut a hole in the cowl.

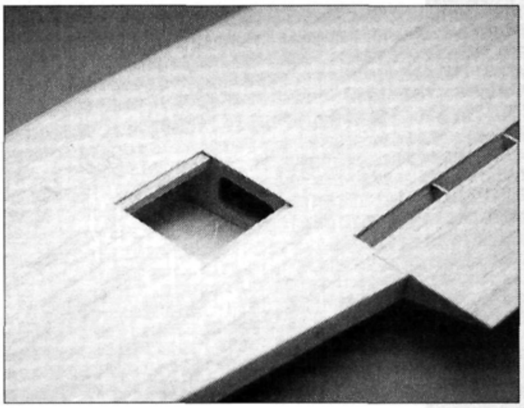
I built the tail surfaces first. The horizontal stab ribs have jig tabs to prevent warps, so be sure your building surface is flat. When you build the vertical fin, be sure the tube for the rotating beacon-light wires is wide enough to accommodate the wiring and the plug. If you build your model like a full-size 182, take a look at the top of the rudder and the fin. Many have an externally molded ridge for added stiffness; this is not shown on the plans.

THE WING

The wing is built in three sections and uses interlocking construction techniques. The instructions get a little carried away with the interlocking and gluing of the many parts, so read ahead of the construction step you're doing. If you get confused, use common sense, ask a friend, or call the manufacturer's customer-service department.

I suspect the main reason you don't see lots of manufacturers offering the 182 is because of its complex shape. For example, when you fly the 182 and look along the bottom of the wing panel, you immediately notice the washout. This model faithfully reproduces that washout by having you build the wing upside-down, and it





Above left: the wingtip is formed out of solid block balsa and has an unusual shape. The navigation and strobe lights and the wiring are hanging from the wingtip hole. Above right: the conventional built-up wing is completely sheeted top and bottom. Building jigs are supplied to ensure proper washout.

SPECIFICATIONS

Model: Cessna 182 Skylane

Type: ⅕ sport scale

Manufacturer: Top Flite

Wingspan: 81 in. (IMAA legal)

Wing area: 906 sq. in.

Weight: 10 to 12 lb.

Wing loading: 25 to 30.5 oz. per sq. ft.

Airfoil: semisymmetrical

Washout built in?: yes

Length: 64.4 in.

Rec. engine: .61 to. 91 2-stroke; .91 to 1.20 4-stroke

Prop used: 16x6 (Top Flite)

No. of channels req'd: 4 to 6 (throttle, rudder, aileron, rudder and optional flaps); 5 to 8 servos required.

Wing: built-up wood fully sheeted

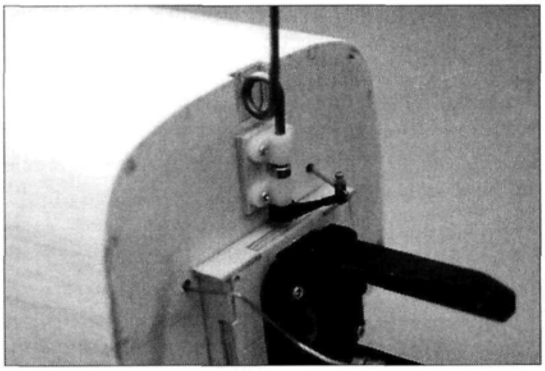
Fuselage: built-up wood fully sheeted and framed upside-down

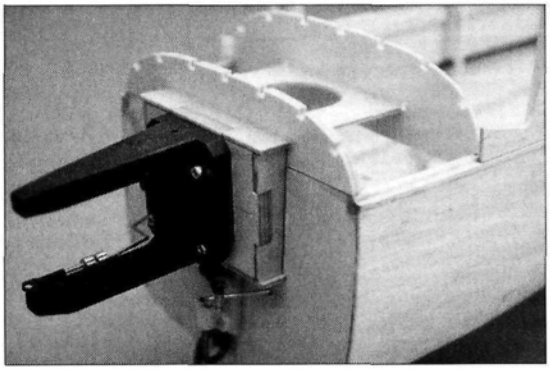
List price: $299.99

Features: precision-formed ABS wheel pants, cowl and strut fairings; three-dimensional CAD engineering for exceptional parts fit; simulated, operational Fowler flaps; extruded ABS "corrugated" plastic strips for scale appearance; formed, pre-drilled, landing-gear struts; shaped, wooden wing struts; formed, clear-plastic cockpit windows; optional lights; jig-built wing to ensure accuracy and washout.

Hits
- Great-looking sport-scale model.
- Well-engineered kit ensures accuracy and superior results.
- Independent main gear struts.

Misses
- White N number decals not opaque.
- Rudder linkage was not in line with rudder hinge line.





Left: interlocking construction makes building a breeze. The parts fit for the whole kit is great.

Far left: the nose-gear installation is straightforward.

FLIGHT PERFORMANCE

by ROGER POST JR.

The Cessna 182 that was used for this flight performance weighed 12.2 pounds and had a wing loading of 32 ounces per square foot. It was powered by an O.S. 1.20 4-stroke and swung a 15x6 Master Airscrew prop. A Futaba* 7-channel radio was used with seven servos (two servos are Y-harnessed for the ailerons, and two servos are Y-harnessed for the flaps). With all of the radio equipment mounted forward of the plane's CG, 2 ounces of nose weight were needed to balance the aircraft. The plane was flown under several types of wind conditions, and it was able to handle all of them. It was set up with maximum throws on rudder, elevator and ailerons, and this helped immensely with gusty crosswinds.*

• Takeoff and landing

With a 1.20 4-stroke, there was more than enough power for takeoff. The plane used about 100 feet of a bumpy grass strip. On the second takeoff, I tried for a more scale-like performance, but I discovered that at least ½ throttle was needed to take off. (A longer, paved runway would have helped to achieve a more scale-like takeoff.) A little right rudder was needed to correct left-yawing tendencies. The climb-out was uneventful, and there was plenty of control throw to compensate for a stiff crosswind. You might need some down-elevator trim on the climb-out because, with the 1.20 producing ½ power, the plane climbs out with a 30- to 40-degree angle of attack. Once in the air, trimming for straight and level flight required only minor adjustments.

The first landing was a dead-stick landing. With a flying weight of 12.2 pounds, the plane's air speed must remain on the high side to avoid stalling. Also, keep the nose pitched down 2 or 3 degrees on the landing approaches, and flare only inches from the ground. If you add the proper amount of up-trim, the Cessna will glide under dead-stick conditions. The second landing was under power, and the plane performed beautifully. The flaps are very effective when fully extended, so be ready to trim for ballooning. Remember to keep a slightly nose-down approach with an adequate air speed. This is important because, with the plane in a full landing configuration, the aircraft will drop the last couple of feet to a touchdown if the air speed is too slow.

• High-speed performance

At a full-power setting on the 1.20, I was able to get the plane to go straight up, and it would have kept on going if I hadn't backed off the power. At around ¾ throttle, the Cessna torque-rolled out of its climb. To achieve a power-on stall, I used ½ power and gradually pulled back on the stick. The plane has a nice, gentle stall and will only break left or right if it isn't pointed directly into the wind. The plane is solid and took every kind of high-speed maneuver that I could think of.

• Slow-speed performance

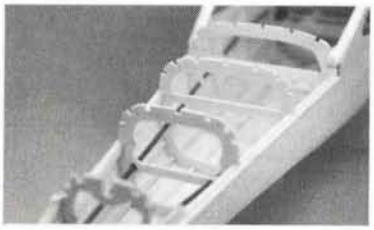
With the flaps extended and the plane trimmed for slow flight, I found that the best way to steer was with the rudder. The Cessna has a very gentle, slow-speed stall, and it doesn't drop a wing if it's pointed directly into the wind. As I stated in the landing portion, the plane will suddenly stop flying if it gets too slow. Weight and balance play a major role in this plane's slow-speed performance so, if at all possible, address this during construction.

• Aerobatics

With a 1.20 4-stroke, this plane is capable of anything. I did spins, rolls, loops, avalanches, flat spins, inverted spins, inverted flight, outside loops, sort of a Lomcevak, knife-edge, knife-edge circles (inside and outside) and straight and level flight with slips to the left and right. When Craig Trachten (the plane's owner) flew it, he did the most violent avalanche I have ever seen on a large plane. It stayed together, and I thought this was a fine testament to the Cessna's structural integrity.

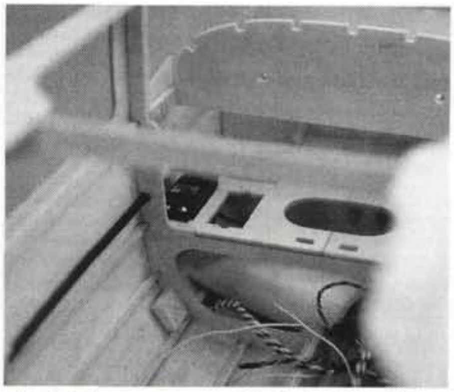
incorporates jig tabs for accuracy. Best of all, when you turn the wing over, there is a different set of jig pieces to maintain that washout.

The plane is completely covered with balsa sheet to simulate the metal skin. Take the time to match the balsa grades, and don't put



The fuselage formers are split horizontally so that the lower fuselage can be built flat on the building board. The upper former halves are added after the fuselage has been removed from the building board.

a soft sheet next to a hard one. Don't use hard balsa where it bends around a curve. If I ever build another Top Flite 182, I'll wait until after the wing has been completely sheeted before I glue the leading edge in place. Also,



The fuselage servos must be installed early. An easier arrangement would be to put the throttle servo in the cabin area.

I'll glue a 3/32-inch sheet-balsa-strip sub-leading edge to the front of the ribs to hold them in place and better support the sheeting.

I did find a couple of places in the instructions that need clarification. In step 1 on page 22, disregard the word "three"; it should be "four," and it's explained in step 3. Step 6 on page 27, where it describes the construction of the flap leading edge, was a little confusing, so look at the plans where the flap cross-section is shown, and make your flaps match that. *[Editor's note: the manufacturer has since corrected the manual.]* Don't omit the flaps when you build your model. If you're afraid of flaps, build them anyway; someone can teach you how to use them later. Yes, they sure are worth the effort.

FUSELAGE

The manual uses bold print to emphasize important points, and it adds notes to help you build the fuselage correctly. Follow the directions here to the letter. If you don't, the top halves of the formers will be off, and the entire cabin assembly will be misaligned. Avoid big trouble and comply!

Build the bottom half first and upside-down; you'll think you're building a boat instead of a fuselage. This unique construction technique ensures a straight, warp-free structure that's light and strong. The bottom half of the fuselage formers and the side longerons are first placed over the plans; then the stringers and sheeting are added. Once the structure is complete, remove it from the board, and add the top half of the fuselage.

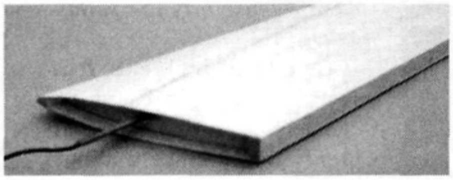
My kit was missing some parts, e.g., the nose-gear bearing block, several 3/16-inch stringers and the main sub stringer. Because I have a shop, it was easier for me to make these missing parts than to send for them. If you have this problem, contact the manufacturer for replacements.

As shown on the plans, the throttle

servo is inaccessible after the fuselage has been completed. The instructions suggest that you cut a hatch into the fuselage to have access to the throttle servo. A better solution would be to install the servo in a more accessible area.

RUDDER NOTES

I found a problem with the rudder horn that wasn't evident until final assembly. As shown on the plan, the entire metal horn linkage is aft of the hinge-pivot center line. Actually, the center of the inner wire should be aligned with the hinge center line. If you build it as shown, it may bind. The problem is compounded by the drawing on the plan that shows how to cut a large servo output wheel to work both the rudder and the nose-wheel steering. If you connect your rudder servo as shown on the plan, you'll end up with much too much rudder throw. I drilled a hole as close to the center of the arm as the pushrod connector would allow, and that gave me the recommended 1-inch rudder travel each way.



All the tail surfaces have scale airfoil shapes and are built using ribs and sheet balsa. The bottom of the vertical fin shows the tube and wiring for the light that's mounted on top.

PLASTIC PARTS

The large ABS plastic parts include the engine cowl, the wheel pants, the formed aileron and flap and the elevator surface ridges. The formed clear-plastic window and the windshield parts fit well. Because plastic and I don't get along well, and I have a good friend who is a master with plastic, I asked him to assemble and finish the plastic parts while I MonoKoted* the wooden structures. The end result was indeed credible—maybe even incredible. I chose to duplicate the box cover on my model, but there are many 182s out there from which to choose.

Although the Cessna 182 is not easy to duplicate, this kit does very well. It takes a lot of time to build it correctly, but it's worth the effort. Perhaps the biggest problem is best expressed by a master scale modeler: "You never finish a scale model; you just get to a point and quit." I highly recommend Top Flite's Cessna 182.

Addresses are listed alphabetically in the Index of Manufacturers on page 126. ■

CENTER ON LIFT

MICHAEL LACHOWSKI

SAFETY WITH TOWLINES

SAFETY IS IMPORTANT. Even though we don't have propellers on our gliders, hand-towing and the launching equipment we use (high-starts and winches) can be dangerous. I want to share some of my recent experiences with winches, talk about new models and comment on some of the latest offerings from Weston Aerodesign. Scale and slope-soaring enthusiasts will be glad to hear about a new publication that will be launched this summer. Finally, I discuss the effects of wind on thermal sources.

PHOTO BY MICHAEL LACHOWSKI

Jack George searches the sky before launching his Waco Mosquito. You can see the trailing-edge sweepback near the tips on Waco's new "banana wing" planform. The tip chord is much larger than those on the previous generation of Waco HLGs.

WINCH SAFETY

After witnessing two winch failures in one day and another one week later, I want to remind you about the dangers of winches and other launching systems. Most will take a 4- to 5-pound sailplane up to 500 feet or more in altitude. That's a tremendous amount of potential energy—all coming from the launching system.

"Jersey" Bill Miller walks back from the spot after another good landing with his Magic 6. The latest version of the Magic features a wing with a very thin (6 percent) airfoil.

Most winches use automotive starter motors. The common Ford long-shaft winch uses a motor that's large enough to turn over a V8. During a launch, the motor draws more than 100 amps, and when stalled, it can draw 500 amps or more. This is more horsepower than your average lawnmower has.

Everything is fine until something fails. The most common winch failures involve stuck solenoids and jammed foot switches. The only cure for these problems is to kill the power by disconnecting the motor from the battery. AMA safety rules require a disconnect switch in the cable that goes to the motor. How this is done varies: quick-disconnect switches, terminals that can easily be disconnected from the battery, and battery-lead connectors that can be pulled apart.

Before attempting to disconnect anything, check to see what the line is doing. If the chute is winding back toward the winch, step to the side in case the line makes it back to the drum before you're able to disarm the winch. This equipment makes a great weed wacker! Do you know how to kill the winch? *Before launching*, you should be familiar with the equipment—*especially the safety features*.

On muddy, wet fields, foot switches can fail because the contacts get dirty. I've seen plenty of switches without bases be mashed into the mud and stop working. Fortunately, this results in a failure to operate rather than in a winch that starts to run all by itself. Of course, I've seen that happen, too—a winch running and no one within 25 feet of it. Make a base for the switch, and paint it with a bright color to make it visible in the grass. This will help people to avoid inadvertently stepping on the switch.

Winch lines can cause nasty burns and remove fingers rather quickly. Disarm the winch before doing any kind of work on the line. All you need is someone accidentally stepping on the foot switch while you're working on the

Winch Safety Tips

1. Know how to disconnect the power from the winches at the field.

2. Always disable a winch before you work on the line.

3. Keep the foot switch dry and out of the mud.

4. Never wrap the towline around yourself. Always think about what would happen if the winch started to run.

5. When you replace solenoids and switches, use brands that work reliably on a winch. Don't jeopardize safety by buying a cheaper part just to save a few bucks.

line. Be careful, too, when pulling winch lines back between launches. It's safest to fold the chute and then hold on to it. If the winch is accidentally turned on, the chute will easily slip out of your hand. Wrapping lines around yourself and putting your fingers through the tow ring invites disaster. As a reminder, I've included a picture of a parachute that was sliced in half by another winch line. I don't think your skin is tougher than rip-stop nylon.

Remember safety when hand-towing or using a high-start. The line can store a tremendous amount of energy, and getting hit with it is far from pleasant. I've seen some nasty burns caused by the mini gorilla high-starts some folks use.

NEW MODELS

Frank Weston keeps coming up with new improved versions of his Magic; the latest is the Magic 6, which sports a very thin, 6-percent WA006 airfoil instead of the previous WA001 airfoil. This thinner airfoil improves the Magic's speed range, and that should help when the wind starts to pick up speed. To deal with the thinner wing, the spar structure has been improved. As always, the latest Waco designs include bagged wings and Kevlar fuselages. Builders out there can buy a kit and do their own constructing. The construction techniques are not that difficult to master, and I've recently seen several new Waco designs made from scratch using simple, but effective techniques.

The WA006 was first used on the Waco Mosquito hand-launch glider. This one has been improved, too. It features the new Waco Advanced Platform that looks like a "banana" wing. The best part is the much wider tip chord, which improves handling and stall characteristics. I flew one built by Jack George, and it had no bad habits. You can fly it as a 2-channel polyhedral ship, but it performs best as a 4-channel HLG. With four servos, the 455-square-inch model's flying weight is 12 ounces, and it's quite maneuverable. This adds to the fun of hand-launch aerobatics and slope soaring in weak conditions.

Are winch lines dangerous? See what happened when a line ran over a parachute? This New England Parachute Co. chute is made of the same materials as full-size parachutes, but it was no match for a fast-moving winch line. Your body wouldn't fare very well against it either.

More information on the Magic 6, the Mosquito 95 and other Waco designs, building supplies and accessories is included in the company's latest catalogue. Contact Weston Aerodesign Company, 944 Placid Court, Arnold, MD 21012; (410) 974-0968; fax (410) 757-8580; e-mail: aerodesign@aol.com.

NEW SOARING PUBLICATION

A new R/C soaring publication is available. *Slope & Scale* is a quarterly magazine that focuses on both R/C scale soaring and slope soaring. Started by Wil Byers and Gregory Vasgerdsian, *Slope & Scale* will cover areas such as slope racing, aerobatics, vintage scale, power slope scale, product reviews and modeling techniques. Its introductory price is $19.95 per year, so if you're interested, contact *Slope & Scale,* P.O. Box 4267, W. Richland, WA 99352; e-mail: wilbyers@aol.com.

Pulling back a parachute? Think about how you hold it. Here's one way to hold the chute so that it can be pulled out of your hand without catching (or keeping) any fingers. You don't want to have your finger stuck in the tow ring when someone accidentally steps on a winch that hasn't been disarmed.

FINDING THERMALS ON WINDY DAYS

The sun's energy can't all be absorbed by the earth's surface; thermals are the results of the earth's radiating part of this energy. We glider pilots get to take advantage of this. Some of the surface areas that produce more thermals are dense forests, fields of crops, the tar and cement of our roads and cities, rock quarries and the leeward side of slopes.

On windy days, we must search for thermals. We can find them over areas that are protected from the wind. Because the wind is not blowing directly over it, the surface of these areas has more time to heat up. Dense forests and crop fields are good sources to check out.

Also, the leeward side of a slope is a good source, especially if there's an area of trees just upwind. These trees house thermals that eventually rise, are taken by the wind and deposited over the leeward side of a slope.

I hope you will find this information valuable. Check out the new products and publications, and be careful with those towlines. ■

LANIER RC 1/3 scale LASER

by JIM ONORATO

BUD LIGHT BEAUTY

The author with his exquisite-looking ⅓-scale Laser (note that Jim is wearing Zurich sunglasses by Newman Optics; they offer outstanding visual and safety features).*

SPECIFICATIONS

Model name: ⅓-scale Laser 200 (no. 94219)
Manufacturer: Lanier RC
Type: competition, sport aerobatic aircraft
Wingspan: 96 in.
Wing area: 1,596 sq. in.
Airfoil: symmetrical
Weight: 22 lb., 8 oz.
Wing loading: 32.5 oz./sq. ft.
Length: 74 in.
No of channels req'd: 4 (7 servos)
Engine req'd: 3.2 to 4.2 2-stroke; 2.4 to 3.0 4-stroke
Engine used: Brison Aircraft 4.2ci 2-stroke gas
Muffler: Slimline giant-scale Pitts-style (no. 2109)
Prop: 22x12 wooden Zinger*

List price: $399.95 (discount price—$199.99)

Features: partially balsa-sheeted foam wing panels; fully symmetrical airfoil; plug-in wings with aluminum spar; built-up tail assembly; vacuum-formed turtle deck, wing cover and canopy; hefty pre-formed aluminum landing gear; ABS cowl and wheel pants; built-up fuselage with die-cut lauan plywood sides; die-cut lite-ply parts and bulkheads; rolled, full-size plans.

Hits
- Excellent flight performance and low-speed stability.
- Easy-to-follow plans and instructions.
- High-quality foam-cores.
- Good-looking overall appearance.

Misses
- I didn't like the lauan plywood fuselage sides and parts.

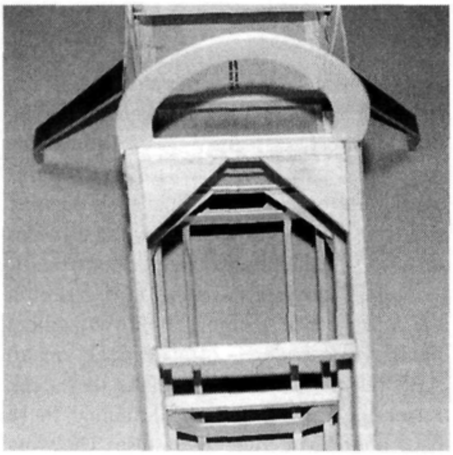
FIELD & BENCH REVIEW

LAST YEAR, I reviewed Lanier RC's* ¼-scale Laser. I was absolutely delighted with its aerobatic capabilities and overall flight performance. Then, at the Westchester Radio Aero Modellers show, Lanier's Bubba Spivey showed up with the prototype ⅓-scale Laser. In no time at all, I convinced him and Tom Atwood to let me review this beautiful plane. This would be my first venture into the world of ⅓ scale, and I was really excited about the project.

THE KIT

The Laser resembles Lanier's other kits in that it has very few parts. The kit box contains mostly foam wing-cores and various plastic parts—few wooden parts. Hardware isn't included, but there's a list of recommended hardware. The 11-page instruction booklet consists of good step-by-step written instructions, but there aren't any photos or sketches. The two sheets of rolled plans are excellent and filled with details. The instructions assume that builders have building experience because, needless to say, this is *not* a beginners' airplane.

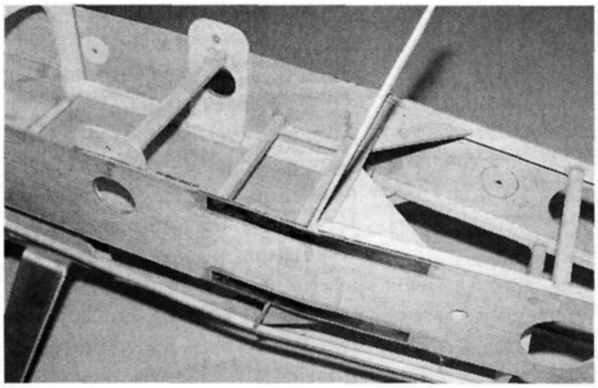
The pilot goes over some last-minute changes before he performs his aerobatics routine. There's a nice color contrast between the graphics, fuselage, canopy and pilot.



Here's how the author beefed up the cuts that were made in the fuselage sides. Triangular gussets are located on the top and the bottom.

CONSTRUCTION

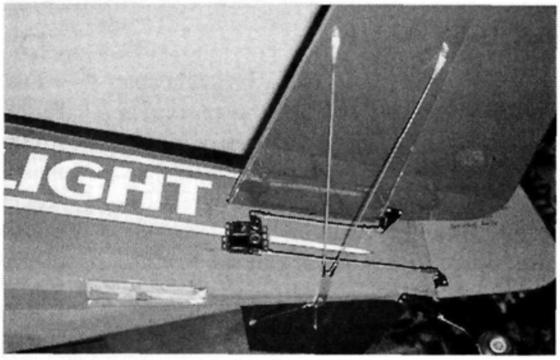
I attached the wing skins and firewall with Great Planes'* 30-minute Pro Epoxy, and I used their 6-minute Pro Epoxy on most of the plywood fuselage parts. For the balsa parts, I used Great Planes' thin and medium Pro CAs and accelerator; and I used white glue to attach the capstrips and spars to the foam wing-cores.



Right: here's the additional bracing that was used on the fuselage cut and the support brace that's across the middle of the fuselage just above the wing spar. Note the carbon-fiber strips.

• **Wing.** The wing is double-tapered and has a symmetrical airfoil. The pre-cut wing-panel foam-cores have to be handled very carefully because of their delicately feathered trailing edges. I used 6-minute epoxy to glue in the fiber wing-spar tubes and white glue to install the four 1/4-inch-square spruce spars in each panel.

In the bottom of each wing panel, I made the cutouts for the servo and servo lead. To do this, I used a cutting/melting tool made by inserting a piece of copper wire into my soldering gun. The wing panels are partially sheeted with 3/32-inch balsa from the forward spar to the leading edge and from the rear spar to the trailing edge. I trued up the edges of the balsa sheets using a long steel straightedge and, following the patterns shown on the plans, I edge-glued the sheets with white glue.



The author cut a hatch for the receiver battery and added 5 ounces of weight to the tail to balance the plane.

FLIGHT PERFORMANCE

Initial flight tests took place on the day after I returned from Top Gun '95. (I was a spectator, not a contestant!) I had just seen Bubba Spivey put his Laser 200 through its paces during several fantastic demonstrations, so I didn't have any doubts about the capabilities of the model I was about to fly. If anything were to go wrong, it would be either me or my equipment. I was anxious to see how the Laser would perform with an average sport flier at the controls. When we arrived at the field, we found a 15- to 20mph crosswind—reminiscent of Top Gun!

• Takeoff and landing

After range-checking my radio with the engine at full throttle, I topped off the tank, said a little prayer, and fired up the Brison for the initial flight. My transmitter was set up to give the recommended throw on all control surfaces at "high" rate.

The Laser felt firm on the ground and taxied nicely with no tendency to nose over. I pointed the plane into the wind and slowly advanced the throttle. The Laser tracked straight ahead without any right rudder. I let it roll about 75 feet, then applied just a touch of up-elevator. The Laser lifted off smoothly with its wings perfectly level. I exhaled!

Landings were quite gentle. The Laser has a shallow glide slope that allows it to descend very slowly. I maintained power until the plane was about a foot off the runway, then applied just enough up-elevator to give it a gentle flare. The result was a very smooth three-point landing.

After my first flight, I realized that I had not made any trim adjustments.

• Slow-speed performance

At slow speeds, the Laser flies safely and is smooth, predictable and very forgiving. It has a low stalling speed and a gentle stall. It can be flown at a very slow speed without losing lateral stability, and it can execute all but vertical maneuvers at partial throttle.

• High-speed performance

At high speeds, the Laser is a "go where you point it" airplane; it tracks extremely well and is a smooth, stable flier. The Brison 4.2 provided more than enough power for the Laser. Using the recommended throw on all control surfaces, I did not encounter any bad tendencies at high speeds. The maximum recommended elevator throw is 1 inch. Using more than that is likely to result in an accelerated high-speed stall that will make the plane roll out at the top of a loop or snap at the bottom.

• Aerobatics

The Laser was designed for aerobatics, and I've seen it do the most amazing things in the hands of an accomplished flier. My flying skills are inadequate to take full advantage of the model's capabilities, but I did put it through some of the more mundane maneuvers. Since all aerobatics are combinations of spins, rolls and loops, you can get a good idea of a plane's capabilities by seeing how well it performs these basic maneuvers.

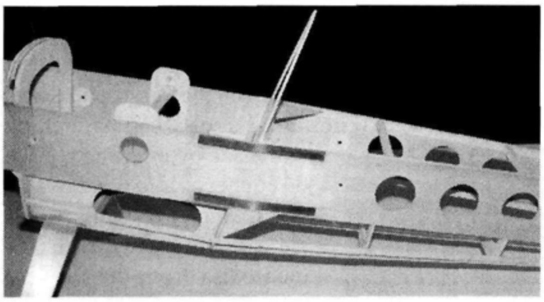
Inside and outside snap rolls were incredibly fast and were done with the plane heading up, down or flying level (it didn't seem to make any difference).

Axial rolls were a little slow at the recommended aileron throw, so I increased the throw by about 50 percent, and the roll rate increased significantly.

Sustained knife-edge and outside 360-degree turns were no problem for the Laser. Spin recovery was within 1/4 spin when the controls were released. High-speed, full-elevator deflection loops (both inside and outside) were made without any loss of heading. When I rolled the Laser to inverted flight, it flew just as straight as an arrow "hands off."

The aerobatic performance of this airplane should satisfy even the most accomplished pilots. It certainly satisfied me!

I applied the skins with a very thin coat of 30-minute epoxy. While the epoxy was curing, I put the sheeted core back into its foam packing pieces and placed this "sandwich" on my pool table. I then covered it with a piece of wood of the appropriate size, weighted this down with six, 5-pound bags of lead shot and let the epoxy cure overnight.



Some of the lower detail on the side of the fuselage. FB1 is the piece with the racetrack pattern cut out of it.

I applied all the sheeting in the same way. When I had finished, both wing panels were perfectly straight. (The 30 pounds of lead shot really did the job!) Using white glue, I installed the capstrips between the spars. When the wing has been covered, the capstrips give it a built-up look.

The remaining work on the wing panels consisted of attaching the leading edges and the root and end caps and cutting out the ailerons. To cut out the ailerons on my band saw, I placed the wing panels in their foam packing pieces to keep them nice and square. Then, following the instructions, I covered the exposed edges with balsa. The aileron hinges are Robart* hinge points. The instructions tell you how to make a simple gauge that will help you to line up the hinge-point holes properly. This worked out very well. I used Precision Aviation Design* Zippy Link control horns and 4-40 pushrods and a ¼-scale servo in each wing panel for the ailerons. To complete the wings, I installed two ¼-inch anti-rotation dowels in each panel.

• **Tail group.** Building the tail feathers was straightforward. They're built up with ⅜-inch balsa stripwood and some ⅜-inch-thick balsa sheet parts. The fin post is reinforced with a piece of ⅛-inch-thick lite-ply, and in the fin and stab, ⅜-inch-square spruce provides the hard attachment points for the tail struts.

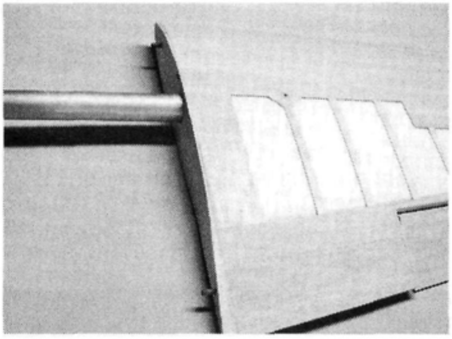
The elevator halves aren't joined because each is controlled by its own servo. Again, I used Robart hinge points for the rudder and elevator hinges. *Do not attempt to fly the Laser without the tail struts.* I used the tail flying wire parts and fittings available from Precision Aviation Design.

• **Fuselage.** The sides and several of the fuselage parts are made of ⅛-inch lauan plywood. To accommodate the engine I planned to use, I laid out where the firewall would go and then cut the fuselage sides to the proper length.

Then, from the cockpit back, I cut nine, 2-inch-diameter lightening holes in both fuselage sides. (They later proved to be unnecessary; my Laser came out nose-heavy.) The fuselage "box" is made with ⅜-inch-square balsa stripwood longerons and crossbraces. I used epoxy to glue most of the plywood parts, and while gluing, I checked with a carpenters' square to ensure that the bulkheads would be square and perpendicular to the fuse sides.

While gluing the second side of the fuse to the bulkheads, I kept the aluminum wing spar inserted through the sides to make sure it would be level and perpendicular to the fuse. The two fuselage sides had to be scored just behind F3, then cracked and glued with thin CA to make the sides straight from F3 aft. This was required to get the turtle deck to fit properly. Because my ¼-scale Laser broke at this point on two occasions, I decided to add some triangular gussets and carbon fiber to strengthen the fuse at this point.

The bottom of the fuse, aft of the cockpit, is made of die-cut lite-ply formers and



The aluminum spar, anti-rotation dowels and the curved root rib that follow fuselage lines.

four ¼-inch spruce stringers. The forward section is made up of ¼-inch plywood parts and a ½-inch-thick firewall. I had some difficulty figuring out how to install the two FB1 formers. They're installed vertically and are inside the stringers.

I chose a Brison Aircraft* 4.2ci engine, and fitted it with a Slimline* giant-scale muffler (part no. 2109). This muffler has a 2-inch-diameter canister and is very effective at noise reduction. To obtain some clearance between the muffler and the fuse, I cut ¼ inch off the bottom of the firewall and fit the ¼-inch plywood bottom between the fuse sides instead of underneath them. Then I glued the firewall to the fuse sides and bottom with Great Planes 30-minute epoxy and pinned it with nine short pieces of ⅛-inch dowel (three pieces on each side and three on the bottom).

Next, I installed the servo rails and built the wing cover frame. The cowl, wheel pants, wing cover and turtle deck are all ABS plastic and give the plane that sleek Laser look. I painted and attached these parts after I had covered the fuse. The wing panels slide onto an aluminum-tube spar and are prevented from rotating by dowels that fit into holes in the fuse sides. I added a cross-brace between the fuse sides just above the aluminum spar to prevent the sides from flexing when the tube spar was inserted.

The panels are held on the aluminum spar with 4-40 socket-head retaining bolts that go through a piece of ½-inch-diameter dowel in the top of the wing and are threaded into the spar. I set the wing incidence at 0 degrees using a Robart Wing Incidence Indicator. If you don't have one of these, borrow one from a friend. This is a critical step. Even with four servos and the battery pack mounted in the tail section, the Laser needed 5 ounces of lead in the tail to get the CG correct.

FINISHING

I covered the Laser with Missile Red, white and Insignia Blue Top Flite* MonoKote and painted the ABS parts and the area around the engine with HobbyPoxy* Bright Red paint, which I applied with a brush; it matches the MonoKote very well.

Almost all of the graphics, including the stars on the fuse and tail feathers, were provided by Precision Aviation Design. I made the stars on the wheel pants out of white and gold MonoKote trim sheet. I installed a DGA Designs* ⅓-scale pilot bust, which I painted with acrylics. His sunglasses are copper wire and clear plastic darkened with a Magic Marker. The final touch was the addition of a 4-inch "P-51"-style Tru-Turn* aluminum spinner.

CONCLUSION

The Laser is easy to build and looks great. It's very aerobatic and has good low-speed stability. I thoroughly enjoyed building and flying it, and I highly recommend it for advanced fliers. The Laser is a proven design by Bob Godfrey, and Lanier RC makes it easy to build.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126* ■

Left: Tom McCoy sends the Thunderbolt on its way. Above: the designer/author with his 1940 pride and jo

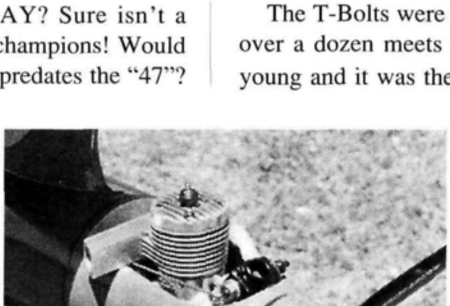
THUNDERBOLT

1940 free-flight champion is converted to R/C

by HAL DEBOLT

"THUNDERBOLT," YOU SAY? Sure isn't a P-47, but both planes were champions! Would you believe that this design predates the "47"? Its young designer was greatly influenced by Carl Goldberg's Valkyrie, which he thought epitomized efficiency. (Even today, do you know of anything prettier than the Valkyrie?)

I hope that its name makes its designer obvious! Like most fine performers, the T-Bolt *evolved* and wasn't the result of a flash of inspiration. When the idea had germinated, the prototype was the classic fuselage mated to an available Playboy Senior wing and tail. Immediate success ended with a flyaway at the Nats (remember, no dethermalizers?). Another version used a Zipper wing and tail. Combined, these two successful models were the inspiration behind the T-Bolt.

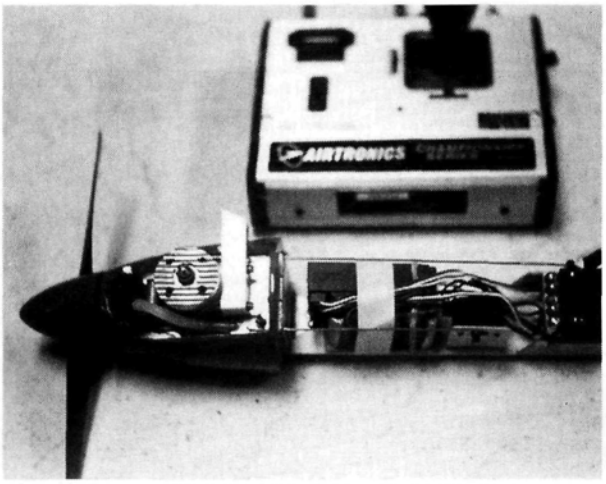


To reduce drag, the fuselage is faired into the spinner.

The T-Bolts were winners—never lower than third in over a dozen meets in western New York state. I was young and it was the Depression era, so I couldn't participate in major faraway contests. The New York State Championships were close by, and the T-Bolts proved their worth there.

The success of the first Thunderbolt was published in the December '43 issue of *Flying Aces* (whose editor took the liberty of calling it the "Whizzawing"); and this led to the concentrated development of a series:

- Class A—the basic design; 280 square inches; .19 power.
- Class B—slightly larger; 350 square inches; .23 power.
- Class C—expanded to 850 square inches to suit the marvelous new Ohlsson .60.
- The last T-Bolt—the most refined version, which I



A removable tray allows R/C equipment access.

chose to replicate and present here.

The decision to build a replica came about when the Society of Antique Modelers people enticed me to have my free-flight designs approved. To me, this seemed useless unless plans would be available. A few years ago, we replicated the Blitzkrieg as a *Model Airplane News* plan; this article should do for the T-Bolt, and the Airfoiler is in the works

RADICAL DESIGN

• The lift produced by the wing and stabilizer are in proper proportion (a design feature that isn't readily noticeable).

• Carl Goldberg's ignition-tray idea allows easy access to the radio equipment and allows precise thrust adjustments to be made.

• Retracts—radical for the time.

• No rudder for trim. Instead, the stabilizer pivoted at the leading edge, and the entire tail was shifted for trim—very effective.

• A dethermalizer—an innovation at the time. Beyond the Thunderbolt's performance, this was its greatest asset. It was accomplished with "spoilers" like those on modern sailplanes.

With this R/C-assisted replica, I thought a normal rudder would be appropriate. Flight tests quickly showed that it wasn't. Under power, the rudder produced a crazy sort of yaw-roll that completely disrupted the climb attitude. I decided insufficient "fin action" was the cause, so I did away with the rudder and made a "full flying fin," which corrected the problem.

CONSTRUCTION

This isn't a stick-and-tissue structure, and its relatively few parts will save you time. But *watch the weight.* Avoid heavy equipment and the temptation to do too much "beefing up."

• **Wing and tail.** If you don't find the drawing self-explanatory, perhaps this one is *not* for you. Beyond that, do use *firm* balsa for the single wing spar. The tail capstrip ribs are easier to shape if they've been soaked in ammonia.

• **Fuselage.** If you've never constructed a "planked" fuselage, you might find it scary, but there's a simple way. It will go a lot faster if you use a "beveling tool," which is simple to fabricate. Cut an 1/8-inch-wide, 1/4-inch-deep groove in the edge of a 1x12-inch piece of hardwood. Then bevel the edge at a 10-degree angle. Put a planking strip in the groove, and use a 60-grit sanding block to bevel it easily and precisely.

To make the planking, follow the steps shown in the sidebar. All the planks should be of soft balsa and glued with aliphatic-resin glue such as Tite Bond. The planking's strength comes from the formed shell of the fuselage and the covering.

Before you complete the upper planking, prepare the equipment tray and install the servos. After that, permanently install the control pushrods.

A true wing saddle is created by planking it on the bottom of the wing. The saddle is then installed on the pylon frame, which then is ready for its 1/16-inch-thick-sheet covering. Do check the wing saddle's angle of incidence and alignment.

In days long past, free-flighter wings and tails were attached with rubber bands, but the T-Bolts used wire hooks for this. For this replica, I opted for the modern method and wonder why we didn't do it years ago.

MOUNTING THE ENGINE

The engine is mounted on maple beams that are inserted into the 1/8-inch-thick plywood "A" former. The height and spacing of the maple beams are determined by the engine used. Be sure that the thrust line is aligned with the center line. For free-flight, we used 2 degrees of right thrust, but we don't need it with the R/C replica.

The engine pod is made of three pieces of medium-hard balsa—one on each side of the beam and a third as a filler below them. Actually, it's convenient to install the 4-40 pod attachment screws and blind nuts before installing the blocks. *[Editor's note: formers A and B form the rear of the engine pod; former C is the front of the fuselage. Attached to the back of this former are two 1/8-inch-square plywood blocks. The blind nuts are inserted into these.]*

With the engine and spinner in place, the entire fuselage can be final-shaped.

FLIGHT PERFORMANCE

If a flight starts with a takeoff from the ground, you will need a second person to hold and release the model. Guide—*don't push!*—the T-Bolt for a foot or so as the run starts. The holder's left hand should *support* the lower side of the left wing panel, while the right hand holds the fuselage down from the top. Then, simply move both hands forward at a natural speed and release. You might call it a "follow-through." No need to push; the T-Bolt will jump into the air!

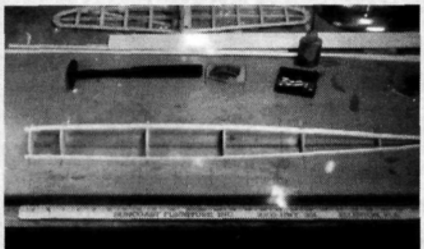
I learned a lesson about modern technology when I powered the replica with a Cox* .15 Conquest glow engine. What power compared with the original Ohlsson!

With the available throttle, I launched at low power, allowed the T-Bolt to climb slowly to a safe altitude, then watched as I added full power. I soon returned to low power to halt the model's uncontrolled antics. I followed this procedure until trim corrections resulted in the nearly vertical straight climb I was looking for. A vertical climb is easily obtained by creating the proper lift proportion between the wing and horizontal tail. If the climb is too shallow, reduce the stabilizer's incidence until a nearly vertical climb is reached. In the process, control the *glide angle* with elevator trim. If the angle is too steep, increase stabilizer incidence until it is satisfactory. Required trim adjustments can be quite minute, so make changes a little at a time.

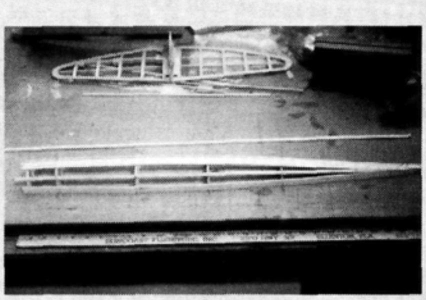
When power-on performance is satisfactory, glide-angle adjustments are made with *balance.* The ideal is a glide angle that's parallel to the horizon. If stabilizer incidence is reduced, the balance point will have to be moved forward; if the incidence is increased, the balance point will have to be moved rearward. The balance point shown on the drawing is a safe place to start.

Minute adjustments can make the difference you need to achieve the ultimate controlled flight. Believe me; it's worth the time and effort.

PLANKING THE FUSELAGE



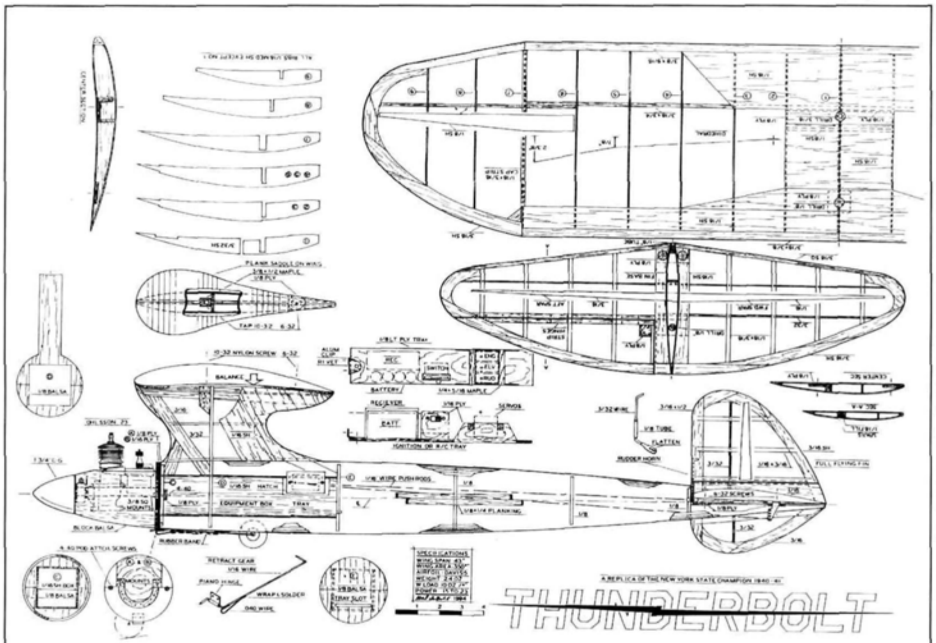
1 *The bulkheads have been halved, and the bottom halves have been erected on a center line. Un-beveled planking strips have been installed at 90 degrees to one another.*



2 *The open arcs have been bisected with another un-beveled strip. Strips, beveled on one side, were added to the strips that were initially installed. In the rear, the narrow strips are fitted by cutting the required angle with a razor and straightedge. Later, do the same with small areas and pieces.*

3 *Here, the bottom half has been removed from the building board and the "tray box" installed. After this, add the upper bulkhead halves.*

4 *At this point, the pylon outline is in place, and the upper planking is under way. Note the access hole in the box in the hatch area and, in the background, the completed tail.*



ORDER THE FULL-SIZE PLAN...SEE PILOTS' MART

Designed by Hal deBolt, Thunderbolt is an R/C version of the 1940 free-flight model. Constructed of balsa and ply, the fuselage has a tubular design and uses planking over formers. The model features a removable engine pod, it requires a 3-channel radio, and it has a pull-out radio tray and a retractable main gear. WS: 43"; L: 35.5"; power: .15 to .23 glow engine; LD 2. **$14.95**

Sand the planking with an 80-grit sanding block until the joint ridges have disappeared; then final-sand with 100-grit. Note that the pod blocks are carved and faired into the spinner.

RETRACTS

It's surprising how well this simple gadget works; you even land on the wheel as the rules once required (still do?). A piece of piano hinge makes a convenient hinge. Bend up the two wire parts, and attach the 0.040-inch-diameter wire rubber-band keeper with soft wire and solder. In the process, be sure that the forward loop of the keeper is *ahead of the hinge line*. Also a *light wheel* is an advantage. Note that when the model sits on the gear, the wheel is *forward* of the hinge line. *[Editor's note: the other end of the rubber band is attached to a little loop hook that's directly underneath former D.]*

To use the retract gear, the leg is extended and the rubber band is pushed upward *past the hinge line*. Hardly any pressure is exerted to retract the gear. On takeoff, the air stream will move the gear rearward thus allowing the rubber band to move down the strut and create the force needed for retraction.

COVERING AND FINISHING

The original T-Bolts were finished in the traditional way—silkspan and dope. We modernized the replica by using Coverite's* Black Baron film for the wing and tail. This is highly recommended because it's easy to apply and is very stable for a long time; once in place, it doesn't have to be "re-shrunk" for years. I also used ¾-ounce glass cloth and epoxy resin. This increases weight by less than 1 ounce, and it sure is durable!

EQUIPMENT

The radio equipment goes on the fuselage tray. I used the fine Airtronics* "mini" system, which has served me well. Because space is limited, a "mini" is pretty much of a necessity, and anything else would be a weight handicap. Note that a pushrod from the R/C switch to the engine compartment makes turning the receiver on and off simple chores. (The tray isn't shown on the plans, but it's clearly shown in one of the photos.)

I'll end by saying that the Thunderbolts were my the pride and joy during the free-flight phase of my modeling. Now they're ready for another campaign. With the help of R/C, this replica has brought back memories of some exciting times. I hope that you'll find some of the modeling pleasure that we enjoyed in the past—and be a winner in the process! ■

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

FIELD & BENCH REVIEW

SPECIFICATIONS

Model name: Sparrow

Type: slope soarer

Manufacturer: Northeast Sailplane Products

List prices: $99.95, $159.95 (pre-sheeted)

Weight: 23 oz.

Length: 36 in.

Wingspan: 65 in.

Wing area: 395 sq. in.

Wing loading: 8.3 oz./sq. ft.

Chord/root: 7 in./5 in. (tip)

Construction materials: fiberglass/Kevlar fuselage, obechi-sheeted white foam wing

No. of channels req'd: 2 or 3

Radio used: Futaba* Super 7

Servos used: Hitech HS-80MG, JR* 341

Features: takes 10 to 15 hours to build; balsa selection is good; hardware package contains all the necessary parts; 24x42-inch full-size plans; four-page instruction booklet (no photographs); available in several versions; ballast system available from Northeast Sailplane Products.

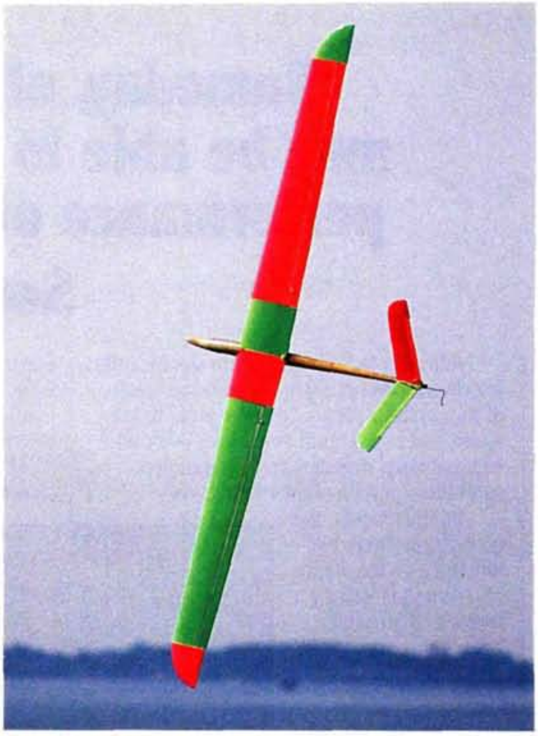
Hits
- Excellent quality
- Easy to construct
- Looks good
- Smooth flight characteristics
- Complete hardware package
- Wide wind range (7 to 35mph)

Misses
- Error in wing-bolt instructions

by BILL GRIGGS

ON MY FIRST slope-soaring trip to Cape Cod, I had the good fortune to see Bob Powers fly a Sparrow. I immediately fell in love with its smooth lines and speedy grace. Bob is a super pilot and he made the Sparrow shine. Incidentally, Bob's Sparrow appears in all Northeast Sailplane* advertisements.

I was new to slope soaring, and I felt I should gain more experience before I acquired such a hot-looking ship; I couldn't have been more incorrect. On the slope, the Sparrow is a real pleasure to fly. The Sparrow is one of my three, "got to have" slope airplanes.



PHOTOS BY BILL GRIGGS

NORTHEAST SAILPLANE

SPARROW

Graceful vee-tail slope soarer

The kit contains two pre-sheeted, obechi-skinned, white foam-cores. The aileron slots have already been cut in the cores; the fiberglass fuselage is reinforced with Kevlar; and the stabilizers and wingtips are machine-cut balsa. Strip stock balsa and pushrods are wrapped in the rolled plans. There's also a hardware package that contains everything you need to complete the plane.

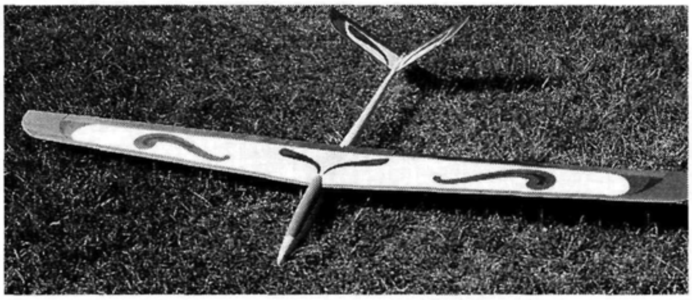
CONSTRUCTION

• **Vee-tail and elevator.** The vee-tail halves are carved out of 3/8-inch machine-cut balsa sheets. First, I drew a line on the balsa to represent the high point of the airfoil; then I marked the midpoints of the leading and trailing edges. I used an X-Acto Spoke Shave (my favorite tool for rough shaping) to carve the stab roughly to shape; then I sanded it to its final symmetrical shape. I used my Sears bench-sander miter table to set the 110-degree angle in the root surfaces of the stabilizer halves. I cut the elevators free from the stab halves, beveled the elevators' leading edges and glued the control horns into place.

The instructions call for a notch to be cut in the fiberglass fuselage for the vee-tail. I thought that this would weaken the fuselage too much, so I mounted the stabilizer on either side of the fuselage with glass cloth. First, I wrapped sandpaper around the fuselage where the stab was to be mounted. I rubbed the stab halves against the sandpaper to set the fuselage curvature into their roots.

Finally, I built a jig so that I'd be able to mount the vee-tail at the proper angle. I made the jig by cutting a 110-degree "V" slot across the width of an 1/8-inch-thick balsa sheet. To set 1 1/2 degrees of negative pitch into the stabilizer, I glued a piece of 1/32-inch-

thick balsa to the jig's trailing edge. Then I set the stab and jig aside until I had completed the wings.

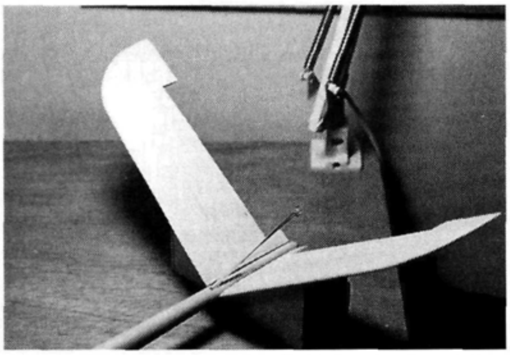


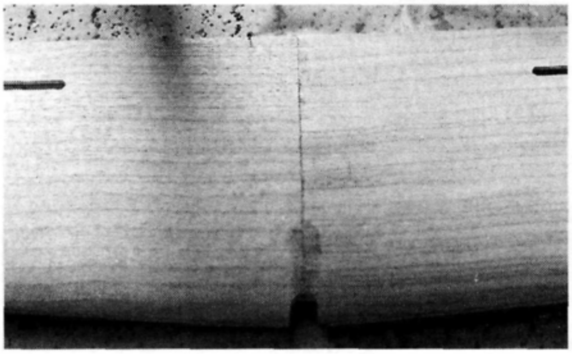
The completed Sparrow showing the symmetrical French curves on top of the wing.

• **Wing.** I chose to deviate from the suggested construction order by building the wing next. I did this because I needed it to set the tail incidence properly. The wing on the pre-sheeted version of the Sparrow requires very little work to finish. It's sheeted with obechi, and the aileron gaps are routed into the cores. The servo-wire patches have been cut into the cores as well.

First, using slow-setting Hot Stuff* UFO CA, I added the balsa leading edges to each panel. UFO doesn't attack foam, and it dries more quickly than epoxy. I also used it to glue the wingtips into place.

I used an X-Acto spoke shave to rough-cut the wingtip and leading edges to shape. I prefer the spoke shave to a wood plane because it takes off less wood and gives you more control. I waited until I had joined the wing halves and put the mounting plates into place before I final-sanded the leading edges.





Above: the vee-tail rests in a jig that not only sets the angle of the tail, but also sets the incidence. The vee-tail is butt-glued to the fuselage and then reinforced with fiberglass. Above right: the wing panel halves have been joined with epoxy. Note the routed-out aileron hinge line.

I blocked up one wingtip to set the dihedral angle; then I sanded the wing root and checked how the wing halves fit together. Having achieved a uniform joint between the wing halves, I vacuumed the root edges to remove the sanding dust, and then I glued the halves together with 20-minute epoxy.

When the epoxy had cured, I sanded the leading and trailing edges and ran 2-inch fiberglass tape over the center joint. Then I lightly misted the tape with 3M 77 spray adhesive to keep it in place while I applied the epoxy. I now have a bubble-free center joint.

I was constructing the spoileron version of the Sparrow wing, so I had to cut cavities in the wing for the aileron servos. The channels for the aileron wiring had already been drilled, so this tedious chore was eliminated. I traced around the aileron servo and made the cuts in the bottom obechi sheeting. Using a flat-blade screwdriver, I gently removed the foam from the servo cavity, then I coated the cavity with 5-minute epoxy to stiffen the wood.

The kit's manufacturer makes the aileron gap in the wing for you. To complete the ailerons, you have only to cut them free with a razor saw and add balsa caps to the bare foam. Bevel the aileron's leading edge to allow the aileron to move freely; then glue in the control horns, and the ailerons are complete.

• **Fuselage/canopy.** First, I installed the wing-mounting plate using 5-minute epoxy, and I sanded it as required to obtain a proper fit. The instructions tell you to drill 5/16-inch holes for the 1/4-20 wing bolts. If I hadn't been in such a hurry, I would have realized this was wrong; they should be 3/16 inch.

Having drilled the holes too large, I bought some 10-32 threaded inserts and 10-32 nylon bolts to fix the problem. The bolts are strong enough to carry the flight loads to which they'll be subjected, yet they're light enough to shear off when the plane lands hard.

I screwed on the wing and made a fixture to hold the fuselage in place while I installed the vee-tail. To ensure that the wing was level with the workbench, I checked it with a Robart* incidence meter. I put the rear of the fuselage and the tail halves into the vee-tail jig. I checked the tail alignment and tack-glued it into place with thin CA. Then I removed the wing and took the fuselage out of the jig. I used epoxy to secure the 1/2-ounce fiberglass to the top and bottom of the vee-tail/fuselage joint.

When the epoxy had set, I installed the pushrod sheath and the antenna tube, mounted the servo rails and installed the canopy. The fuselage was then ready to be painted.

PAINTING AND COVERING

I painted the fuselage directly with Krylon spray paint, which does a fine job of covering, dries to the touch in 15 minutes and can be handled after an hour. I save time and weight by not using primer.

The obechi sheeting on the wing was beautiful—nice grain and smooth finish. I thought it would be a shame to cover it, so I looked for a way to show off the wood. My method wasn't the best one!

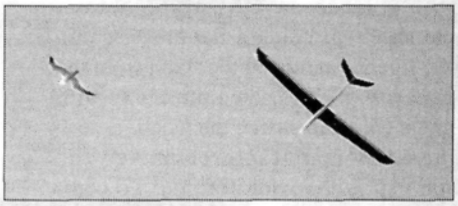
A simple, effective system holds the canopy in place. A 1/16-inch-diameter music-wire alignment pin holds the front of the canopy, and a Carl Goldberg Models hatch lock is attached to a screw on the fuselage.*

FLIGHT PERFORMANCE

• Launching
With a moderate toss into a light wind, the Sparrow climbed out easily. I have flown the Sparrow in winds as slight as 7mph and as brisk as 40mph (ballast recommended). In high wind, it's best to launch quickly with both hands so that the plane isn't torn out of your grasp. Launch with a slight, nose-down attitude to ensure that flying speed is attained.

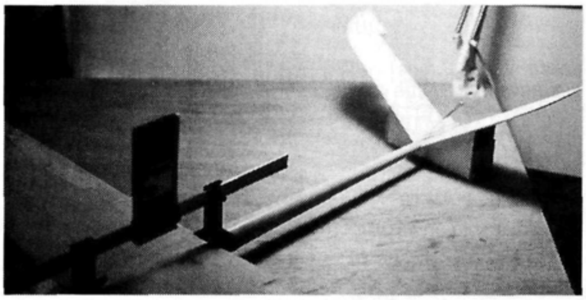
• High-speed performance
To get the Sparrow up to speed, just drop the nose slightly. The Sparrow flies very smoothly with no signs of negative flight traits. It has a fast, flat glide, and it's very responsive to aileron control. With speed, rolls are flat and axial and loops are tight. It isn't easy to stall the Sparrow at any speed, but when it does stall, it's straight ahead and shows no tendency to drop a wingtip.

• Low-speed, control sensitivity
With the ailerons deployed as flaps, the Sparrow will slow down quite nicely. Droop the ailerons about 35 degrees (with elevator compensation). This makes the plane look as if brakes have been applied. Without down-elevator compensation, the plane will balloon upward slightly when the flaps are lowered, but this is usual with model planes.



• Aerobatics
The Sparrow will do more complicated aerobatics than I'm capable of—any aileron and elevator maneuver that you can think of. Rolls are moderately fast and axial. Loops can be big and smooth or tight and small, depending on your mood and speed. Inverted flight takes more elevator than I expected, but I think this is because of the stabilizer's negative angle. I haven't tried a spin or a snap roll.

Obechi isn't as porous as balsa and it contains more natural oils. It's therefore difficult to cover it with a film that was designed to cover balsa. I discovered this *after* I had covered the wings with Clear Super MonoKote*! The MonoKote stuck well to the edge of the obechi, but for some reason, it didn't shrink tightly and it trapped air bubbles.



Before the vee-tail is glued into place, the wing is set level and checked with a Robart incidence meter. The tail is aligned with a jig to set the angle at 110 degrees.

To keep the obechi's natural color, I suggest that you use Flecto Varathane, which can be rubbed into the wood with a soft cloth. It seals the wood without adding weight.

You could use a film such as UltraCote* Plus, which has its own adhesive backing, but you'll only get one shot at putting the film on without wrinkles. UltraCote Plus is only available in opaque shades, so you can't have a clear finish show through.

RADIO/RECEIVER INSTALLATION

• **Radio.** I installed the elevator servo in the fuselage and used a Du-Bro* Kwik-Link to secure the pushrods. The elevators use music-wire pushrods, which are unique because they're mounted together in a single pushrod tube.

The aileron servos are held in place with clear packing tape. The HS-80MG metal-gear servos are slightly thicker than the wing, so they stick out a little into the breeze. I hard-wired the servos permanently into place.

The aileron pushrods are short lengths of 2-56 pushrod wire with threaded ends. They make a very tight connection with no detectable slop.

• **Receiver.** I originally intended to install a Hitech/RCD* Micro 535 receiver, but when I balanced the Sparrow, I discovered that it would need 1 ounce of nose weight if I used the Micro 535, so rather than carry around useless weight, I installed a larger receiver.

I used a Hitec Ultra HFD-07RF 7-channel receiver. Although it's a tight fit in the Sparrow, it's a good replacement receiver and costs only $54.95. It solved the balance problem, too. To increase the Sparrow's aerobatics performance, experienced fliers could move its CG back to the 40-percent-chord mark.

FINAL THOUGHTS

At the slope, the Sparrow is in its element. It flies big, smooth loops and rolls and really burns up the sky. It was a pleasure to build, and it's even more of a pleasure to fly; I recommend it to all soaring enthusiasts.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ■

HOW TO

by CARL RISTEEN

PART 3

Improving Flight Performance

Simple ways to improve lateral controllability

THE FIRST TWO installments of this series ran through some basic theory of lateral controllability and stability and some ingenious schemes that airplane people have devised to make their creations better behaved. This concluding installment will visit washout, wingtip and vertical-tail appendages and offer some simple, well-proven cures for bad-tempered models.

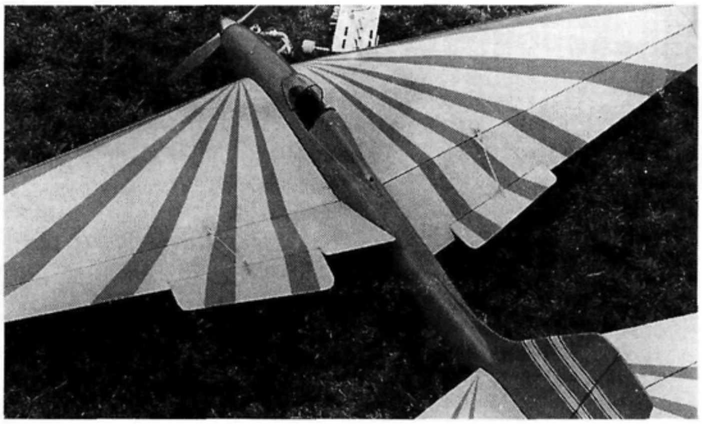
TIP PLATES AND WINGLETS

Figure 1. Pilots of early jet fighters were surprised to find that attaching external wingtip fuel tanks helped rather than hurt performance. Wings clawing for lift in thin air at high altitudes needed high lift coefficients that wasted a lot of energy in generating powerful tip vortices. The vortices were caused by high-pressure air under the wing attempting to shortcut around the tips and join the low-pressure air just above it. Although the tanks produced drag, by hindering the flow of air around the tips, they actually reduced net drag.

Way back in the days of wire and canvas, wind-tunnel tests had demonstrated that, under the right conditions, wingtip plates could be helpful. Circular plates with a diameter of twice the wing chord were attached at right angles to the long axis of a test wing with an aspect ratio of 6. The plates reduced net drag by 15 percent at a lift coefficient of 0.8. At a lower aspect ratio or a higher lift coefficient, a considerably greater improvement would be expected. Unfortunately, the big plates had a bad effect on drag at lower lift coefficients that corresponded to moderate altitude cruising and top speed. Improvement showed up only above a lift coefficient of 0.5.

Tips plates languished in limbo for about half a century. Designers reasoned that simply extending the wings a little would reduce drag just as much at high lift coefficients. In addition, longer wings would impose a far lighter drag penalty at low lift coefficients.

More recently, NASA engineers and others, armed with shiny new knowledge of the complex air gyrations around the wingtips, resurrected tip plates in the form of vertical "winglets." Winglets look more like broad-blade knives than plates. Their much smaller area slices the air with only a fraction of the low-lift drag of large tip plates. In truth, those old designers weren't all wrong. Tests demonstrated that winglets actually do their drag-cutting job best when they are pointed, not up, but straight out—in effect, simply extending the wing. But a straight wing extension imposes a greater bending load over the entire wing, and that slaps on a hefty weight penalty. Longer wings also chew up costly terminal and hangar space. Winglets currently serve up better performance to a flock of late-model airliners and executive haulers.



View of boost tabs on 60-inch-span sport/fun fly model. Boost tabs let much smaller, lighter servos do the job, and less weight equals better low-speed control.

Their ability to reduce drag at high lift coefficients and to also add useful lateral area to a model with a super-light minimal fuselage attracted me to conventional tip plates. Tip plates can also outperform winglets at the highest lift coefficients, and they don't add unwanted dihedral effect. I wanted a combination of the quickest possible loops and rolls and decent knife-edge for good rolling maneuvers. Increasing wingspan would normally be a shorter route to quicker loops, but it would hurt roll rate and weight.

Tip plates should help even more on competition fun-fly models with very low-aspect-ratio wings. On the downside, flat-out contest flying entails very rough landings and the nuisance of frequent plate re-attachment. Tip plates do present an unusual visual impression that can be a little unsettling during the first few flights.

LATERAL AREA AND STALL/SPIN

A few years ago, NASA, responding to concern over too many accidents, subjected a number of common light aircraft to the rigors of military-spec. handling tests. Most of them flunked badly. Alarming, in view of the fact that such aircraft are commonly flown, not by rigorously trained military pilots, but low-time Sunday afternoon fliers. A number of scale R/C models served valiantly as guinea pigs. The NASA boffins found that auxiliary lateral area in various forms, including winglets, and subfins under their tails improved handling and spin recovery.

AERODYNAMIC CLEAN-UP

R_x For Better Handling

Aerodynamically unclean things, such as uncowled engines and open cockpits with poorly shaped windshields, spill turbulent, slower-moving air over the rear fuselage and tail assembly, reducing yaw resistance and thus hampering controllability. Investment in a thorough general cleanup will frequently pay handsome dividends in overall

handling, not just in drag reduction. Sealing control-surface gaps should also be considered. Full-scale tests indicated that a gap equivalent to 1/32 inch on a 10-inch chord reduced control-surface effectiveness by about 30 percent, although the effect on yaw should be much less.

SUBFINS AND SUBRUDDERS

Figure 2. A propeller produces thrust by whacking the air passing through it with a rearward kick of momentum. Unfortunately, unless the prop is of the counter-rotating variety, it also imparts a twist to the air stream. The corkscrewing propwash interacts with every part of the airplane it meets. The wing and tail surfaces, in particular, tend to de-twist the flow. In exchange, they receive a reactive torque that partially opposes engine torque.

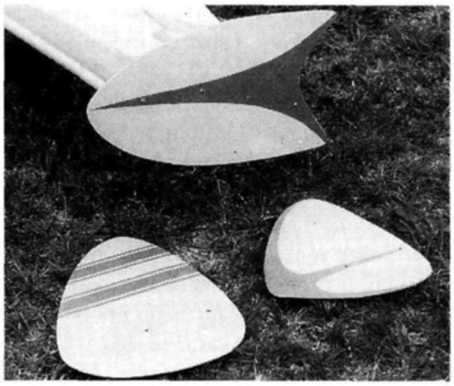
The part of the vertical tail that extends above the thrust line receives a force to the right from the corkscrew propwash, and that tends to yaw the airplane to the left. Vertical tail surface below the thrust line, however, receives a force to the left, and that helps oppose the left yaw. If you craftily divide the vertical tail into two roughly equal areas, above and below the thrust line, the left and right forces will be about equal, and yaw will be minimal.

Wing camber, and wing incidence that is positive with respect to the thrust line, will deflect the helical propwash downward a little, causing it to intersect the vertical tail lower and to increase the left yawing tendency. Adding downthrust raises the propwash and helps reduce left yaw under power. (As air speed increases, the same angular momentum is shared by a lot more air, and the propwash becomes proportionally less twisted.)

I have an aversion to measurable thrust offsets in aerobatic models. Zero offset, up, down, or sideways, is my ideal. In the real world, you usually have to compromise a little. Practically all airplanes have various asymmetries that tend to produce unequal drag above and below the thrust line. External exhaust systems, hung on one side, flapping in the breeze, clearly produce a left/right drag imbalance. The usual Band-Aid is a little downthrust and right thrust. Unless it had a highly unusual layout, most fliers would regard with suspicion a model having upthrust and left thrust. But if they simply roll their trusty model upside-down, that is exactly what it has.

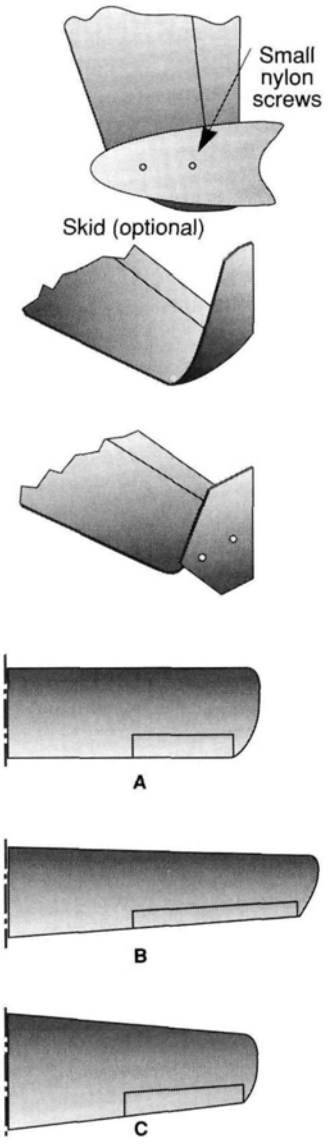
The problem with thrust offsets is their tendency to produce accurate tracking over only a narrow range of air speed, attitude and power. The ideal aerobatic model clings tenaciously to a dead-accurate vertical upline, regardless of air speed or power setting. I find that designing out the need for thrust offsets makes trimming much easier. On a new model, I often have to fiddle with subfin and dorsal fin areas to get them right. Still eluding me is a way to get rid of a slight right-rolling tendency on vertical dives with the throttle setting at idle. I usually have to crack the throttle open a hair to reduce windmilling torque and cancel the roll.

In my opinion, subfins are the simplest, most direct route to the elimination of power-induced yaw and the need for slovenly corrective right thrust. For maximum control, I like to accompany the subfin with subrudder area to make the rudder intersect as much of the propwash as possible. (This really helps in nailing those stall turns.) A bonus: the subfin and subrudder bathe in clean, fast-moving air; this contrasts with the slower, more turbulent air that spills off the wing root and fuselage at high angles of attack. Close to stall, when you need all the anti-yaw help you can get, I think that sub-



Selection of tip plates. Various tip plates tried on 60-inch-span sport/fun-fly monoplane. If tip plates have more area above the wing, they have the same effect as dihedral. Conversely, this can be used, with much less total area, to trim yaw/roll coupling. Plates retained by small nylon screws; break away without damage. Largest plates (shown attached) work best.

Figure 1.



Simple tip plate
Considerable parasitic drag, but tip loss reduction cuts overall wing drag at higher lift coefficient (tight turns). No dihedral effect if area moments above and below wingtip are about equal. Small plates can be used to fine-tune yaw/roll coupling. Best shape?

NASA winglet
More efficient than tip plate, but adds less yaw-resisting area. Reduces overall drag down to lift coefficient under 0.25, but dihedral effect (yaw/roll coupling may hurt aerobatics).

Winglet variation
Equal area above and below wing; no dihedral effect; slightly less efficient. Ground clearance a problem; breakaway mount is a good idea.

Wing planform
Important in aileron drag/yaw reduction as well as in overall drag and weight saving.

Wing "B"
Same root chord and area as wing "A," but tapered 33%; 20% longer span; approximately 3% more lift; 10% less profile drag; 24% less aileron yaw; 36% less induced drag. Can weigh about same as "A."

Wing "C"
Same span and area as "A," but tapered 40%; slight increase in lift; 10% less profile drag; 3% less induced drag; approximately 20% less aileron yaw; approximately 20% lighter than "A." Less weight at tips lowers mass moment of inertia and improves damping of yaw oscillations (numbers are approximate). Taper advantages are hurt by low Reynolds numbers.

fuselage vertical tail area is twice as effective, area-for-area, as surface area higher on the airplane.

Airplanes with pusher propellers behind their tails do not suffer from corkscrew slipstream-induced yaw to any degree. Unfortunately, they are also denied the torque cancellation a conventional tractor propeller layout gets from the interaction of the helical propwash with various airframe components. High-performance single-engine pushers have suffered heavily from unmitigated torque; example: Japanese Kyushu J7W—an ultra-high performance canard fighter hailing from 1945.

SCALE EFFECT AND HANDLING

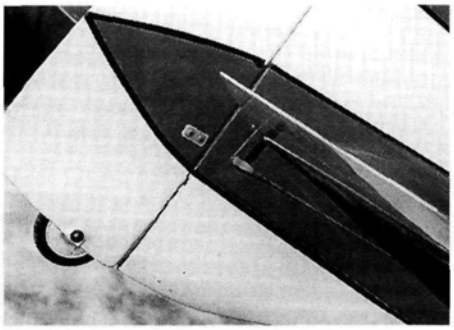
I have detected something peculiar lurking about scale models. They seem to have worse handling characteristic than their full-scale counterparts, and things get worse as the scale gets smaller.

Some of this evil influence is probably caused by air turbulence and pilot eye/hand response factors that inevitably degrade the smoothness and "flyability" of small models. I suspect that Reynolds number gremlins may also be implicated. Reynolds number effect is tied to air viscosity, and it becomes increasingly significant with small-scale models, as air starts to act more and more like molasses.

Reynolds-number effect increases drag and reduces lift as scale is reduced. Aileron-induced yaw is caused by unequal drag between the left and right wing panels when the ailerons are deflected. At low Reynolds numbers, the lift-to-drag ratio of a wing worsens. (For a given amount of lift, more drag is suffered.) Similarly, it seems reasonable that at low Reynolds numbers, the lift difference between the left and right wing panels that you need for good roll control would produce a greater left/right imbalance in aileron-induced drag. Result: the yawing drag couple produced by the ailerons could become more troublesome. On the helpful side, low Reynolds numbers produce a gentler stall. (See Andy Lennon's "Understanding Airfoils" in *Model Airplane News,* January '95.)

Our hyperactive model engines easily overcome the overall drag increase but can do little against unbalanced aileron drag, other than do their energetic best to accelerate out of trouble. Aileron-induced yaw must be controlled by careful aileron design and rigging, wing washout and maybe a little cheating in the form of additional yaw-resisting lateral area, particularly in that hard-working vertical tail. Designers of small free-flight rubber-powered models have used this trick for a long time. Flying at low Reynolds numbers results in more air getting dragged along with the fuselage. This reduces its velocity over the tail feathers, thus hurting the vertical tail's ability to provide vitally needed yaw resistance.

Although I base this on years of R/C flying, it's mostly speculation. I haven't found much published hard data relating controllability to Reynolds numbers.



Subfin and subrudder with enclosed tail wheel on 68-inch-span bipe. Improves low-speed handling, requires no thrust offset. Thickened lower end of rudder holds 1⅞-inch Williams Bros.* wheel.

FURTHER SCALE-MODEL HINTS

Crash-wary scale modelers will attempt to duplicate such features as the aileron differential and wing washout found on the full-scale ship. They were used for very good reasons and are probably even more important at reduced scale. We R/C fliers are deprived of most of the helpful sensory inputs that full-scale pilots take for granted. We can use all the help we can get. A slightly queasy feeling in the pit of the stomach instantly reminds a full-scale pilot when he is flying a little sideways. By the time our ground-bound eyes tell us that trouble is imminent, it may be too late for corrective rudder. In any case, hitting just the right amount of rudder to correct a tight situation is extremely difficult in the speeded-up reality of small-scale flying.

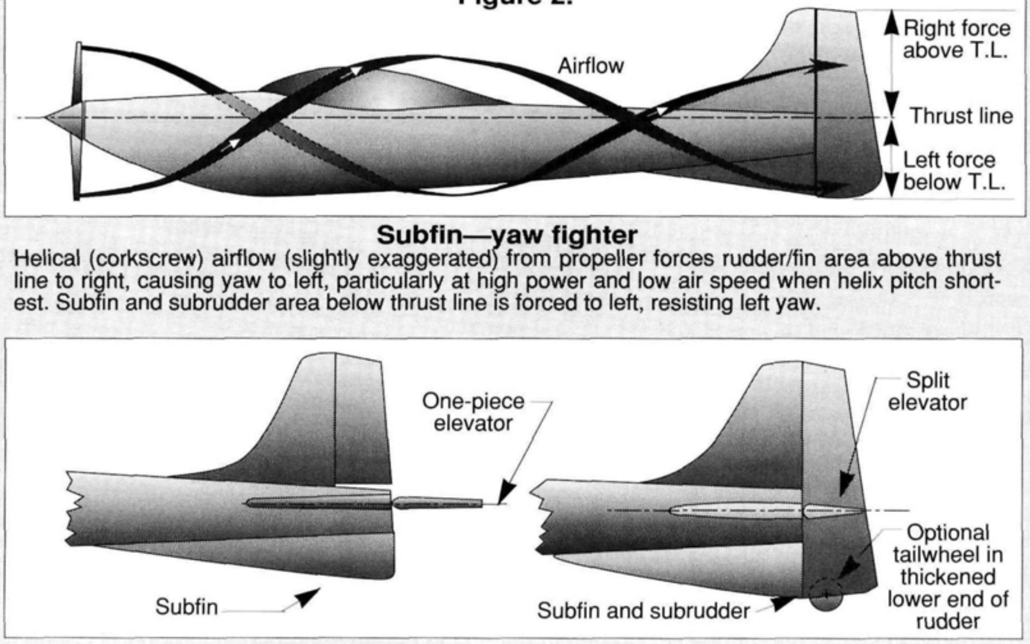
Denied the assistance of educated feet dancing on the rudder pedals, the vertical tail gets demoted to a more passive role. A little cheating, in the form of a larger vertical tail area, cunningly disguised by faithfully duplicating the scale profile, will help many models, particularly the trickier-to-fly, smaller ones.

Before giving up on that dog, you might try one or more of the following simple treatments:

WASHOUT

Figures 3 and 4. Not the stygian ordeal of Fang's annual bath, washout is a warp (one

Figure 2.



Subfin—yaw fighter
Helical (corkscrew) airflow (slightly exaggerated) from propeller forces rudder/fin area above thrust line to right, causing yaw to left, particularly at high power and low air speed when helix pitch shortest. Subfin and subrudder area below thrust line is forced to left, resisting left yaw.

Subfin/subrudder variations
Subfin alone: helpful retrofit to boost lateral controllability by reducing yaw. Particularly helpful with floats.

Subfin/subrudder combination: boosts both yaw resistance and rudder effectiveness by placing maximum rudder height in propwash. Better stall turns, handling and knife-edge. Particularly helpful with many bipes.

of the few helpful types) in which you twist the wing to a lower angle of incidence, usually 2 to 5 degrees, at the tips. On a 10-inch chord, 2 degrees is equivalent to raising the trailing edge about 3/8 inch; 5 degrees, about 7/8 inch. Even 1 degree will help.

Washout helps to prevent tip-stall and cuts aileron-induced yaw by reducing the wingtip area's angle of attack. Tip-stall makes the model dynamically unstable in roll, it kills aileron effectiveness, and it can cause the model to roll in a direction that's opposite to aileron deflection. Washout also reduces overall drag by producing a spanwise lift distribution that is a closer approximation to the ideal semi-ellipse.

• **Adding washout.** Washout may be added to a wing by twisting it while heating the covering. I stand a hot plate on edge to free both hands for twisting the wing, while I eyeball the result from directly above and behind the trailing edge. It takes a little practice to size up wing warps by sight, but it's worth it. Be careful not to melt a hole in the covering.

A much slower, but safer route: prop a heat gun up on a table, or clamp it in a vise. Move the wing away from the heat, but before you inspect the fruits of your labor, keep twisting it for a few seconds more while the covering cools and stiffens. The wing should retain a fair amount of twist. It may take two or more treatments, a few hours or days apart, to let the structure yield enough to make the twist permanent. Be careful to wash out the right and left panels equally. The ailerons should also be washed out to align with the airfoil of the washed-out wingtips. A little additional washout in the ailerons never hurts.

Fully sheeted foam wings are too torsionally stiff to respond much to this simple treatment, and excess heat may lift the sheeting. Warping the aileron trailing edges upward at the wingtips by 5 degrees or so is a compromise here. This is much less effective than wing washout, unless your ailerons have an unusually wide chord. I have managed to de-warp and wash out such wings by various medieval contrivances of jigs and clamps, weighted levers, etc., rigged to apply a strong twist in the desired direction. Most wings will eventually tire of this torture, and yield. Be patient—like any good inquisitor.

Raising the neutral position of the ailerons by 5 degrees or so by adjusting the control linkage is also helpful, particularly with barn-door (wingtip-mounted) ailerons. This is a quick field fix to get some of the effect of washout and aileron differential in a hurry.

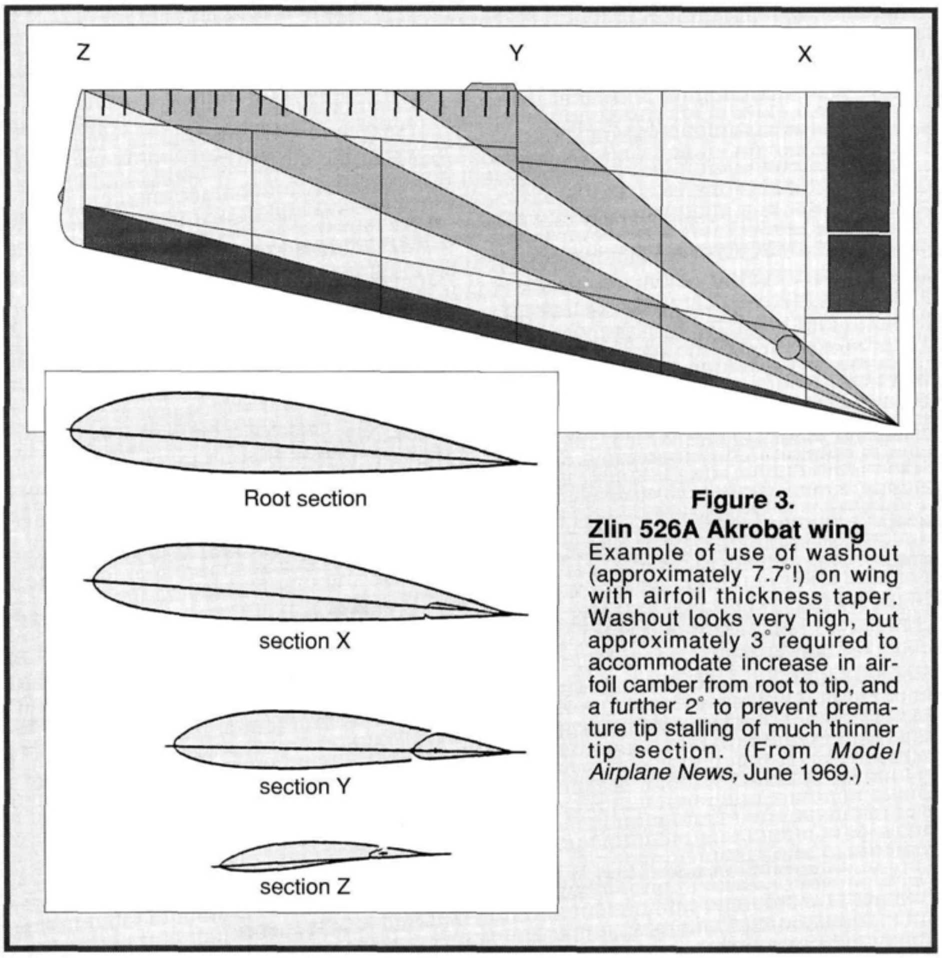


Figure 3.
Zlin 526A Akrobat wing
Example of use of washout (approximately 7.7°!) on wing with airfoil thickness taper. Washout looks very high, but approximately 3° required to accommodate increase in airfoil camber from root to tip, and a further 2° to prevent premature tip stalling of much thinner tip section. (From *Model Airplane News,* June 1969.)

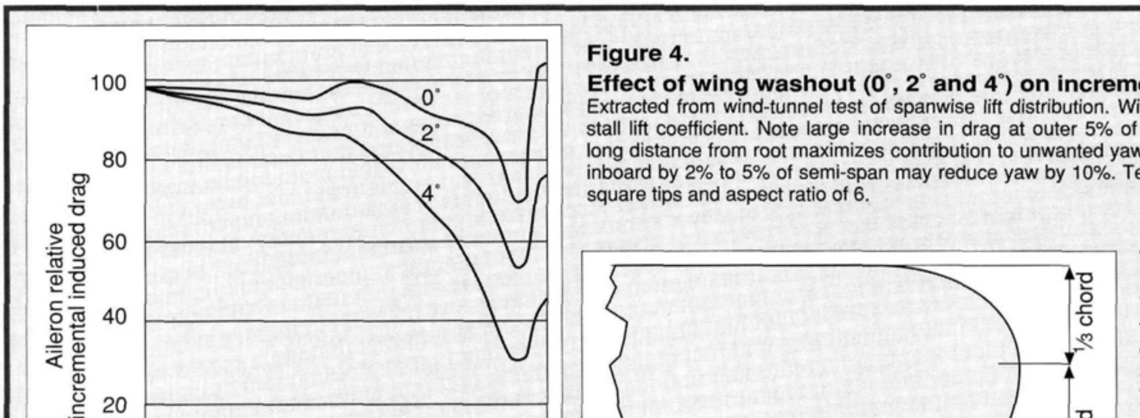


Figure 4.
Effect of wing washout (0°, 2° and 4°) on incremental aileron drag
Extracted from wind-tunnel test of spanwise lift distribution. Wing at approximately 90% of stall lift coefficient. Note large increase in drag at outer 5% of semi-span, where relatively long distance from root maximizes contribution to unwanted yawing moment. Moving aileron inboard by 2% to 5% of semi-span may reduce yaw by 10%. Test wing had constant chord, square tips and aspect ratio of 6.

Wingtips are important
Wind-tunnel tests revealed this shape to be best for constant-chord wing with aspect ratio of 6. Compared to square tip, induced drag reduced by about 5%; profile drag by 5%. Slightly inboard aileron reduces aileron yaw. Curves are quarter-ellipses with major axis about 1⅔ times minor axis.

Washin—the opposite of washout—also has the opposite effect, and it should be avoided like the worst of plagues. Flying a model with washin can be a handful, like tussling with a pack of rabid pit bulls.

Designers of full-scale aircraft frequently taper the wings, not only in planform, but in airfoil percentage thickness as well. Scale wings may have a tip thickness of only 8 to 10 percent of the chord, but a root thickness of as much as 18 percent. The thick root section increases drag, but it saves a lot of structural weight. The thinner tip section helps aileron response and cuts drag, but it also stalls at a considerably lower angle of attack, necessitating up to 5 degrees (sometimes more) of washout, particularly if airfoil camber increases toward the tip (Figure 3). Models that duplicate the scale-thickness taper look far more realistic, but they absolutely *must* have washout to avoid horrible handling.

AILERON DIFFERENTIAL HELPFUL AND SIMPLE

This is more "up" than "down" aileron travel. Many full-scale airplanes use it to promote friendly handling by reducing aileron yaw. If your model is close to stall, lowering an aileron to try to raise a low wing produces little additional lift on that side and a lot more drag. The extra induced drag of the lowered aileron will tend to yaw the model toward the low wing, and dihedral responds to yaw by trying to roll the model further in the direction of the yaw, only making things worse. Many high-wing trainers I have encountered had measurable aileron differential in the wrong direction—more "down" than "up"—even though their builders had followed the plans faithfully.

Aileron differential can be obtained by bending the strip aileron horns backward on high-wing models, or forward on low-wing models, as shown in Figure 5. You can also use an output wheel instead of a straight arm on the servo, with the aileron pushrods attached about 30 degrees ahead of the servo output shaft for a high wing, or the same amount behind for a low wing (Figure 6).

If your model has barn-door ailerons, a further linkage trick is to use 60- or 120-degree bellcranks in place of the more common 90-degree items. I would start with about 50 percent more "up" travel than "down," except on models intended for serious aerobatics, where differential must be carefully fine-tuned by flight testing. To get much more than about 50 percent differential, a combination of output wheel offset and angled aileron horns, or non-90 degree bellcranks will work better. Up/down ratios of two or more are frequently used on full-scale aircraft to get forgiving low-speed handling. Aileron differential can also be obtained by using a separate servo for each aileron and using computerized mixing to get unequal up/down travel.

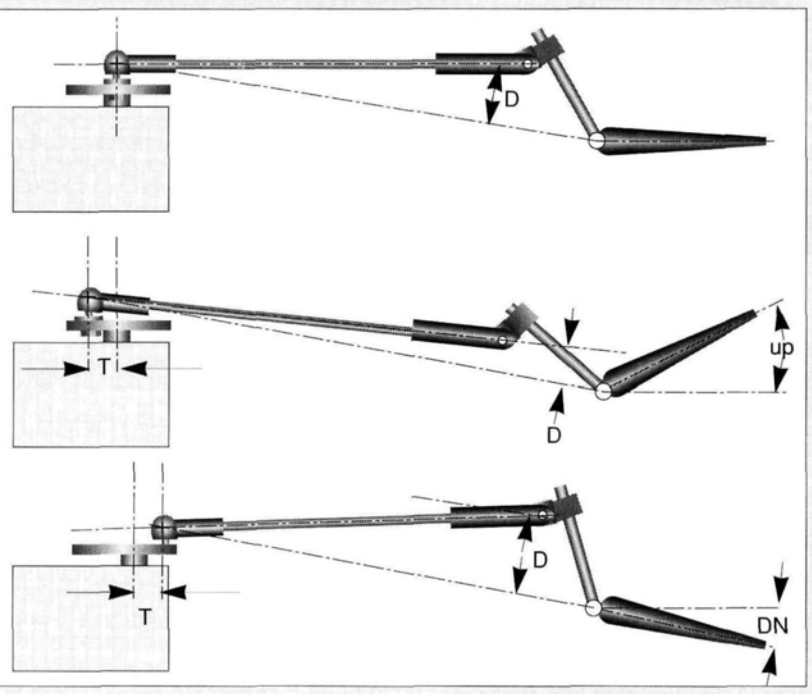


Figure 5.
Diagram of strip aileron control linkage for low-wing airplane to give aileron differential travel. Horns inclined forward to give more up-travel than down-travel. Distance "D": the effective moment arm of the horn decreases as aileron is raised, acting like a shorter horn. The opposite effect occurs when the aileron is lowered, and distance "D" increases, acting like a longer horn, reducing travel in down direction, although servo-arm throw "T" is the same in both directions.
(Note: aileron horns inclined forward for low-wing model as shown. For high-wing model, with linkage inverted, incline horns backward by same angle.)

AILERON/RUDDER COUPLING

You can usually counteract aileron-induced yaw by moving your rudder in the direction of the turn by the correct amount. You can also program a computer radio to deflect the rudder automatically in response to aileron control input. This is called aileron/rudder mixing, and it can be very helpful if you aren't yet a maestro at the rudder. Aileron/rudder mixing can make models with a Piper Cub-type layout much friendlier to low-time fliers.

The trouble with aileron/rudder mixing is that relatively large rudder movement is needed to counteract aileron-induced yaw at low air speed, but much less is needed at high air speed that lets the rudder develop far more force. If your control system knew how to compensate for air speed, everything would be fine. Some full-size light airplanes solve this problem by using springs in their control mechanisms to reduce rudder deflection at higher air speed. A few misguided designers, striving for car-like airplane controls, even dispensed with the rudder pedals. They argued that jumping on the rudder pedals at an inopportune time has projected many a low-time pilot into far worse trouble than would have resulted from a little inaccuracy of rudder movement. Even the Wright brothers tried it, but soon reverted to independent rudder control to get side-slipping capability. Aileron-mixed rudder travel that is reduced as air speed increases would be very helpful—but tricky to incorporate into a model control setup.

ADDITIONAL VERTICAL TAIL AREA

(Long-tailed puppies can relax!) By itself, this is probably the most effective of the basic fixes. A slew of models I have encountered needed more rudder and fin area. It makes them better natured and, thus, less inclined to snap (roll) at you when you mistreat the sticks. Try taping a trial cardboard extension to the rudder trailing edge. If your rudder control, by itself, is already effective enough, you might reduce rudder travel at the same time. Some poor-handling models I have run into needed more than double the original vertical tail area for best results. Don't be shy about adding area—cardboard is cheap; you can always take it off. A couple of trials will usually be needed to zero in on the optimum. If the cardboard experiment helps (I have never seen it fail),

permanently enlarge the rudder or fin, or both.

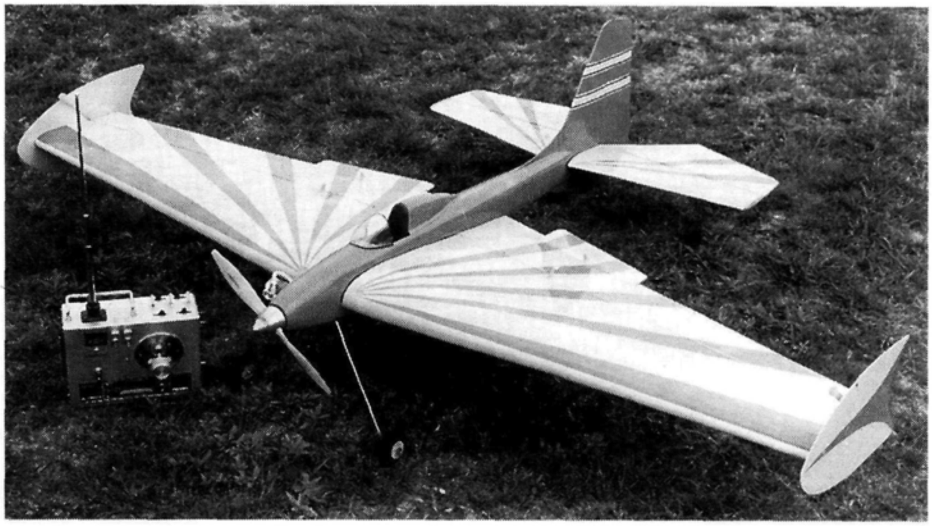
WASHOUT AND AILERON DIFFERENTIAL—THE DARK SIDE

There is a tradeoff to the use of washout and aileron differential in the form of reduced controllability while flying inverted. In inverted flight, washout becomes washin, and aileron differential is in the wrong direction. If good inverted handling (low air speed or tight outside turns) is important to you, you can't use as much washout and aileron differential as you might like. Additional vertical tail area can come to the rescue. It almost always improves controllability, whether upright or inverted. Excessive vertical-tail area can hurt spiral stability, as I mentioned previously. In anything but a primary trainer, the improvement in lateral controllability usually more than compensates for the reduction in spiral stability.

Similarly, aileron differential causes rolls to barrel outside a little and causes the nose to drop a bit upon entering a turn. If you have a computer radio, you can correct this by aileron/elevator mixing. The trick is to try all the fixes and zero in on the combination that works best for you.

ARTIFICIAL TURBULATORS

Full-size airplanes frequently sprout various protrusions from their wings that are intended to produce turbulence and provide a smoother progression to stall. This whole area can be very tricky, because the results tend to be very sensitive to Reynolds numbers. Things that work well at full scale may be much less effective or—in extreme cases—may have an effect that's opposite to that intended. This is especially true at the much lower Reynolds numbers typical of smaller-scale models.



Original 60-inch span sport/fun-fly model. Design experiment intended to get competition fun-fly performance with more realism. Goes like scalded cat, but is pattern-capable. Wingtip plates of epoxy-laminated balsa plywood are retained by small nylon screws; break away without damage in mishaps. Tip plates reduce induced drag, making the wing act as if it had a larger span. Keeping span short helps roll rate—very important in fun-fly competition. Model handles better; knife-edges far better with tip plates attached. Also loops faster with better tracking. Weight—48 oz.; wing area—720 sq. in. Webra Speed .50 with mousse-can type muffler. Boost tabs on flaperons allow micro-servos to handle all functions. Mass dampers on flaperons and elevators; no flutter at well over 100mph, despite very light structure.

Sharpening the leading edge of the inboard one-third or so of the wing will tend to reduce the maximum lift coefficient and produce a gentler stall at a lower angle of attack. The outer part of the wing remains unstalled, so the ailerons can remain effective while loss of lift inboard drops the nose safely, preserving air speed. You might try taping triangular pieces of balsa, with an angle of 45 degrees or less facing forward, to the inner part of your leading edge. The exact angle may take some fiddling with to get the results you want.

Some free-flight modelers have reported good results at rather low Reynolds numbers by using spanwise-oriented threads cemented to the outer one-third of the wing, quite close to the leading edge. The threads are intended to produce a turbulent boundary layer that tends to make the air stream stick better to the wing and resist stall separation. (The boundary layer is the slow-moving layer of air that is very close to the surface.) Thickness is critical. A thread that's too thick can act more like a spoiler and worsen flow separation.

Boundary layer control by surface protrusions is best left to the (very) patient experimenter. Getting more deeply into this now would probably interest only a few readers, and in any case, I can't relate a lot of personal experience or success.

In conclusion, just about every part of an airplane can play a role in improving handling. Some of the more effective devices have a way of complicating construction and adding weight. The basic fixes—washout, aileron differential, aileron/rudder coupling and especially additional vertical tail area—have radically improved the disposition of many an ill-natured model. If you happen to be haunted by a snapping, evil cur skulking somewhere in the nether regions of your shop, why not coax the poor creature out for a little helpful therapy?

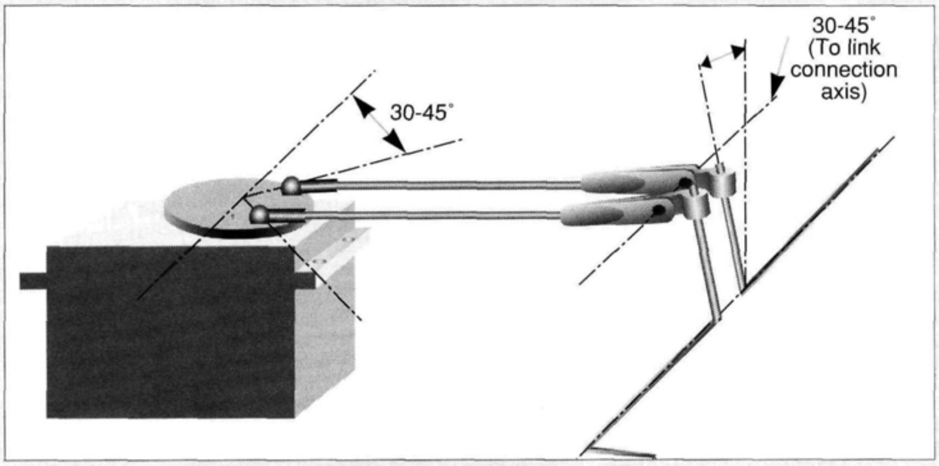


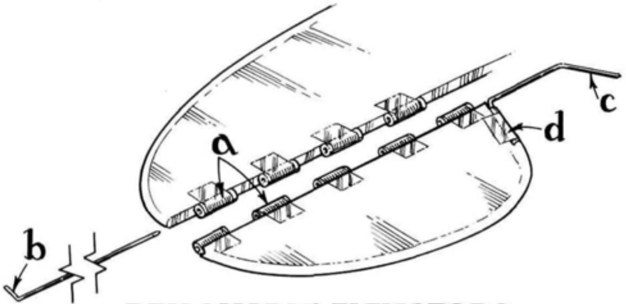
Figure 6.
Basic arrangement of offset-hole servo-output wheel with angled horns for larger aileron differential travel. Pushrod travel reduced for downward aileron movement, while horn moves closer to perpendicular to pushrod, thus increasing the effective length of the horn. Gives more differential travel than inclined horns alone. Ball joints advisable on servo output wheel to accommodate angular movement of pushrods in vertical plane. (Note: This setup is for a low-wing model. Move the pushrods to 30° forward of the servo output post and incline horns backward for a high-wing model.)

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ■

HINTS & KINKS

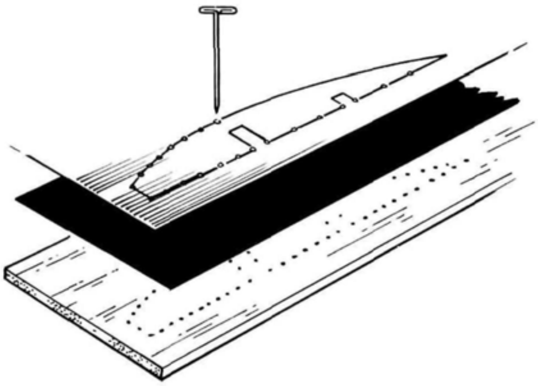
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



REMOVABLE ELEVATORS

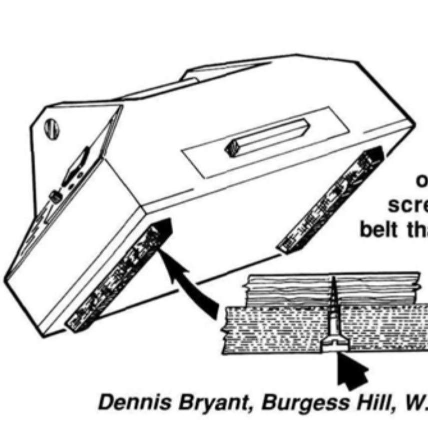
Glue ½-inch (13mm) lengths of aluminum tube (a) to the stabilizer and elevator, then cover each with a patch of glued micafilm. Removable 1/32-inch music-wire hinge pins (b) can be held in place with clear adhesive tape. Elevator joiner wire (c) is plugged into the tubes (d) to allow the elevator halves to be removed independently. R/C glider fliers do much the same thing, but they use segments of Nyrod for a nonmetallic hinge. They're handy because they're removable. *Bob Hansen, Muskegon, MI*



DISAPPEARING PIN HOLES

To make pin holes visible, place a sheet of carbon paper below the plan before pin-pricking the outline of the parts.

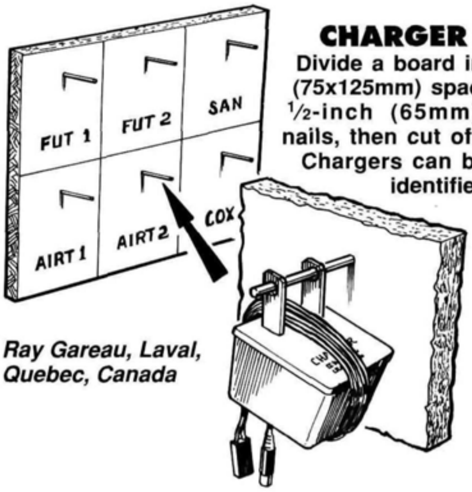
Harvey Stiver, Havelock North, New Zealand



V-BELT FEET

To make nonskid feet for the bottom of the flight box, screw on pieces of V-belt that have been drilled and counter-bored. Sink the screws so that the box doesn't scratch the piano top.

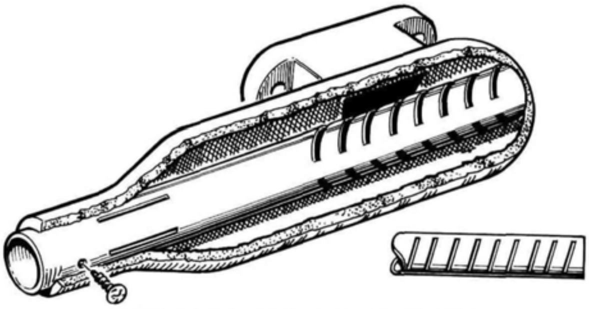
Dennis Bryant, Burgess Hill, W. Sussex, England



CHARGER CADDY

Divide a board into 3x5-inch (75x125mm) spaces, drive in ½-inch (65mm) finishing nails, then cut off the heads. Chargers can be hung and identified as shown.

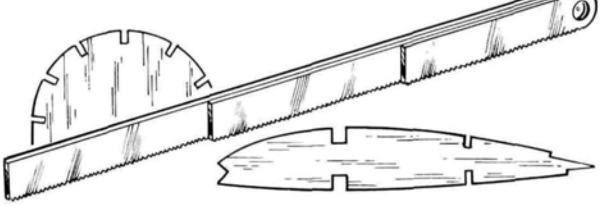
Ray Gareau, Laval, Quebec, Canada



QUIETER MUFFLER MOD

Brass or aluminum tube is slotted top and bottom with a Dremel grinder; it's then de-burred and force-fit into the muffler where it's secured with a small sheet-metal screw. Note the additional horizontal drain slots at the exit end. Marc claims that this muffler is much quieter and increases rpm slightly.

Marc Stermer, Sanatoga, PA



THREE-WAY NOTCHER

Richard bolted and taped together three pieces of hacksaw blade as shown. Now he has a three-in-one notching tool that cuts three notch sizes in formers and ribs. To adjust the width of the notch, carefully grind the "set" off the sides of the teeth. Instead of tape, why not use CA or epoxy (keep it clear of the teeth)?

Richard Piccola, Scottsboro, AL

FIELD & BENCH REVIEW

Durable .40-size plane with a symmetrical airfoil

U.S. AIRCORE

COROSTAR II

by ROB WOOD

"IF YOU HELD a beauty contest with all the bald eagles at the local zoo and used a panel of R/C pattern judges for scoring, none of the eagles would win! None has a pair of evenly matched wings, none is perfectly symmetrical and all of their tails wiggle. Funny thing, though; they all fly just fine." This is the answer that George Barker, co-owner of U.S. AirCore* Inc., gives to criticism that his company's products are ugly, have bent trailing edges and less than perfectly aligned tail sections. Our experience with the Corostar II, the latest generation of their popular 40-size sport plane, seems to reinforce George's analogy.

Let's face it: no U.S. AirCore model will ever win a scale contest, or a pattern contest, or a beauty contest. On the other hand, if someone were to run a contest for durability, ruggedness or longevity, the AirCores would probably make a clean sweep.

One of the reasons for the nearly unbreakable nature of AirCore structures is the material used in their construction—a twin-wall (corrugated) extrusion of polypropylene plastic that bends along the corrugations while remaining stiff at right angles to them. Folded, triangular spacers between the walls also ensure a very tough skin for the fuselage and flying surfaces. This makes the finished model surprisingly stiff where it needs to be and flexible and "giving" everywhere else. Models built of traditional balsa and ply might break during an "unscheduled landing," but an AirCore model simply bends. In most cases, the bent material will "pop" back into its original configuration with a little coaxing.

The Corostar II is assembled in the same way as the rest of the kits in the series: the model is folded along predetermined lines and contact-cemented together. Last year, Bill Griggs did an admirable job describing the AirCore assembly process in "KnightHawk: A Plane for All Seasons" (*Model Airplane News*, January 1994), and I

SPECIFICATIONS

Name: Corostar II

Type: low-wing sport plane with fully symmetrical airfoil and modest aerobatic capabilities

Wingspan: 56 in.

Wing area: 560 sq. in.

Weight: 5 lb.

Wing loading: 20.6 oz./sq. ft.

Length: 41 in.

Engine: .40 to .50 ball-bearing 2-stroke recommended

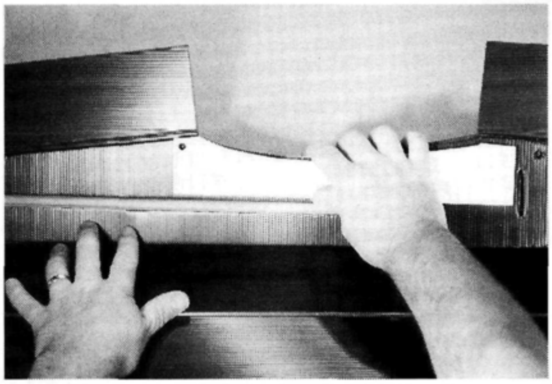
No. of channels req'd: 4 (aileron, elevator, rudder, throttle; flaps optional)

List price: $119.95 plus S&H (available for less than $100 with a little shopping)

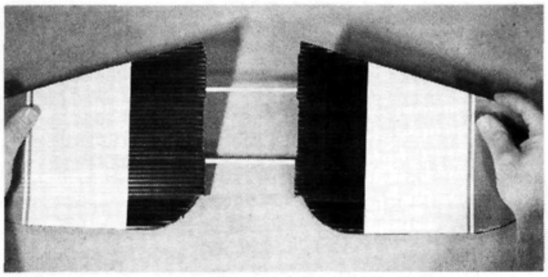
Kit construction: prefabricated twin-wall polypropylene extruded plastic

Hits
- Quick and easy to build (approximately 40 hours from box to sky).
- Strong, light and flexible—able to take abuse.
- Sliding, interchangeable power cartridge makes setup a breeze.
- Gapless hinge system eliminates flutter potential, increases flying surface.
- Efficient.
- Good flying characteristics.

Misses
- Ailerons and elevators would benefit from increase in area.
- Difficult to keep trailing edges and flying surfaces straight.



The rear spar is being inserted into the wing.



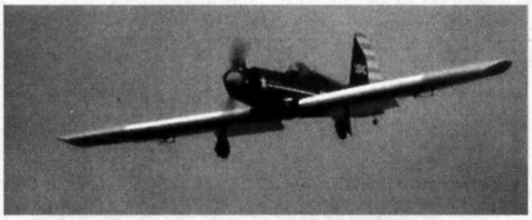
To ensure accurate alignment, trial-fit the tail surfaces.

FLIGHT PERFORMANCE

The U.S. AirCore Corostar II is what it claims to be: a reasonably priced, nearly indestructible low-wing sport plane that requires modest skills for construction, flies basic sport and aerobatic maneuvers in an acceptable manner and is easy to fly (if precautions are taken with prop balancing, straightening flying surfaces with heat or hot water and proper CG placement).

• Takeoff and landing

The Corostar II behaves with predictable efficiency on the ground and in the air. The symmetrical airfoil allows smooth aerobatic maneuvers, while the washout and flaps allow the airplane to fly at a crawl.



• Low-speed performance

With flaps at 30 percent, the Corostar II seems incapable of stalling at any speed, but it did require down-elevator mixing to prevent it from ballooning.

• High-speed performance

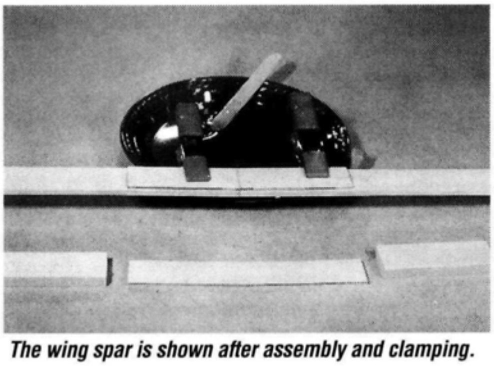
Moderate elevator trim adjustments were required to transition from slow to high speed, but these can be eliminated by shifting the CG—a task made easy by the sliding power core. The Como .40 on the tuned pipe produced more than adequate power for high-speed flight, and the aircraft showed no tendency to flutter or to be unpredictably skittish at higher acceleration.

• Aerobatics

I put the Corostar II through the 1994 IMAC basic routine, with results as follows:

General tracking characteristics—acceptable.
Adverse yaw—acceptable for a sport plane.
Inverted flight—excellent, with minimal elevator correction.
¾ loop (square back side)—excellent.
½ Cuban-8—smooth transitions.
Immelmann—satisfactory (roll rate a bit slow at the top).
2-point roll (3 seconds)—a bit sluggish.
Split S's—excellent.
½ reverse Cuban-8—excellent, owing to the symmetrical airfoil.
Inside loop—excellent, with no drop-off.
Hammerhead—acceptable, but fell off to the left.
Humpty Bump with a pull, ½ roll down—acceptable but slow on the roll.
Cuban-8—excellent.

The Corostar II has more than enough rudder authority for any maneuver; I was able to fly a complete 360-degree knife-edge around the field with no problem. The power-to-weight ratio was a bit on the lean side with the Como .40 though—even with the tuned pipe—and I was only able to hang the airplane on the 10x6 prop for 10 seconds. I suggest a .45 or .50 2-stroke engine for maximum performance.



PHOTOS BY ROB WOOD

The wing spar is shown after assembly and clamping.

have little to add to his thorough treatment of the subject, except to say that the Corostar II features several improvements over its predecessor: pre-decorated with built-in colors and markings, built-in washout in the wings, single-piece tail feathers, gapless hinges and improved, one-part pushrods.

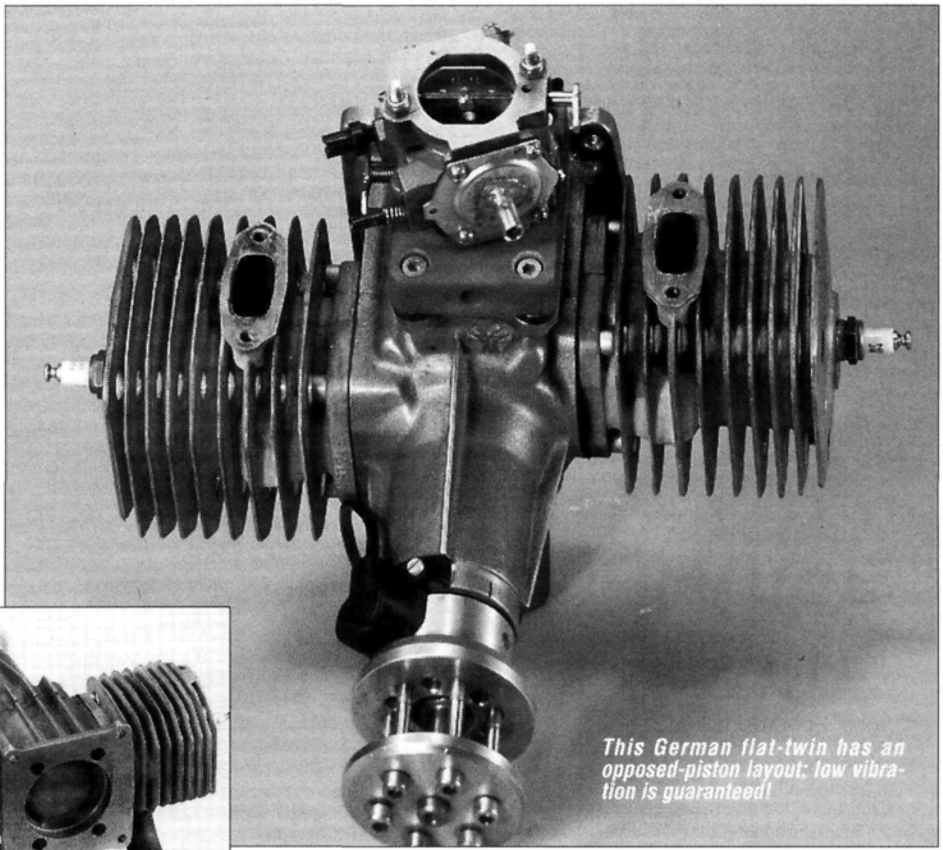
** Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ■

ENGINE REVIEW

3W 120B2

70cc (4ci) TWIN 2-STROKE

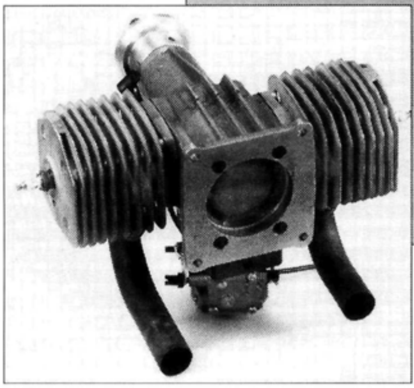
by MIKE BILLINTON



This German flat-twin has an opposed-piston layout; low vibration is guaranteed!

FOR REALLY LARGE model aircraft, the flat-twin 2-stroke has a lot going for it. Single-cylinder engines with capacities of 70cc (4ci) or more produce a lot of vibration, which many models can't take for too long. Their rpm therefore have to be restricted to modest levels. But the flat-twin can range much more smoothly up the rpm band, and can, if necessary, use more robust reciprocating parts without any extra vibration. The German 3W 120B2 has an opposed-piston layout that guarantees very low vibration levels.

Going beyond the twin to a flat-4 or flat-6 in search of high power is a problem because of the greater overhang from the rear radial mount to propeller, which again places some constraint on higher rpm. And some people think that, for racing, the single-cylinder engine is still a force to be reckoned with because of its greater horsepower/cubic-inch ratio (because of their fewer internal reciprocating parts). For example, in the USA's Formula One pylon-racing class, the Webra 75cc (4.6ci) single-cylinder engine is being developed, but the jury is still out on the outcome. The respective rpm capabilities and the minimum usable prop-blade areas of flat-twin and single-cylinder engines are both certain to have some bearing on which becomes dominant.



Chunky solid structure leads to high torque/weight ratio. 10mm spark plugs fitted.

PACESETTING POWERPLANT

Designed for serious competition use, the 3W 120B2 has always been a pacesetter, but in large-scale racing here, it's now caught between two camps: too big for Formula One (capacity limit 75cc) and at the mercy of much larger, more powerful engines (drone engines of 250cc and more) in Unlimited racing. (In Unlimited, only the maximum-engine-weight regulation of 14 pounds and overall maximum model weight of 55 pounds is preventing engines with even larger capacities from being entered!)

Meanwhile, the 3W 120B2 is very much in evidence among large-scale models at the TOC. In an area where the last thing any pilot needs is to worry about engine operation, its solid, consistent, vibration-free performance stand it in good stead.

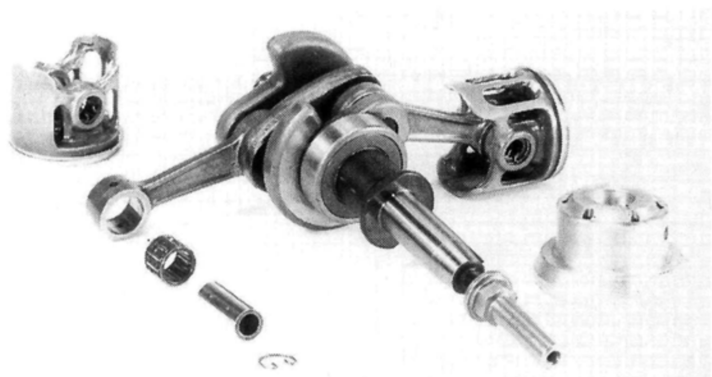
Its distributor, Desert Aircraft*, supplies standard back-pressure mufflers that have been tested at 95dB (measured at 9 feet). The manufacturer also pushes the considerable merits of tuned-pipe use; with this particular engine, using one is a very controllable, easy procedure that provides a very adequate rpm bandwidth of performance.

MECHANICAL DETAILS

Structurally, the 3W range of engines (from single to flat-6) effectively supersede the converted industrial engines, but contain many of the same elements as those workhorses:

- steel rods with hardened faces;
- needle-roller big and little ends;
- one-piece aluminum head and cylinder (internally chromed);
- pumper diaphragm carburetors (supremely efficient);
- twin-throw crankshaft with pressed-in crankpins (both nickel-chrome);
- three large ball bearings to support the crankshaft—all fitted with patented seals that are effective even when their diameter becomes worn, so the crankcase stays airtight for a long time;
- 6mm cylinder and crankcase bolts in heavy-duty aluminum alloy.

Weighing 1.5 pounds combined, the radial mount and rear crankcase half form a



Heavily cut-away piston skirt is for boost port breathing. Note modified extension to main shaft.

WEIGHTS AND DIMENSIONS

Capacity	6.969ci (114.20cc)
Bore	1.772 in. (45.01mm)
Stroke	1.413 in. (35.89mm)
Stroke/bore ratio	0.797:1
Timing periods	Exhaust –153° Transfer–116° Boost–112° —Blowdown 18.5°
Combustion volume	6.2cc (per cylinder)
Compression ratios	Geometric 10.2:1 Effective 7.14:1
Exhaust-port height	0.470 in. (11.94mm)
Cylinder-head squish	0.024 in. (0.62mm)
Cylinder-head squish angle	2.5°
Squish-band width	0.338 in. (8.60mm)
Carburetor bore	0.90 in. (22.86mm)
Main crankshaft diameter	0.669 in. (17mm)
Crankpin diameter	0.550 in. (13.99mm)
Crankshaft nose thread	5x0.8mm bolts
Wristpin diameter	0.471 in. (12mm)
Connecting-rod centers	2.56 in. (65mm)
Engine height	7.25 in. (184mm) to top of carb.
Width	9.75 in. (248mm) across heads
Length	7.75 in. (197mm) radial mount/prop driver
Mounting-hole dimensions	3.18x3.52x0.24 in. (80x90x6mm holes)
Exhaust-manifold bolt spacing	1.57 in. (40mm)
Frontal area	29.2 sq. in.
Weight	8 lb., 6.5 oz. (3.813 kg.)–bare 10 lb., 2 oz. (4.593 kg.)–with t/pipe and manifold
Crankshaft weight	2 lb., 1.5 oz. (949g)
Piston weight	2 oz. (56g)
Wristpin weight	0.50 oz. (14g)
Conrod weight	1.9 oz. (54g)

PERFORMANCE

Maximum B.hp 14.30 @ 9,031rpm (pipes @ 580/600mm)
12.58 @ 9,600rpm (open exhaust)
Maximum torque 1,880 oz.-in. @ 4,860rpm (pipes @ 700/800mm)
1,680 oz.-in. @ 3,923rpm (open exhaust)

RPM ON STANDARD PROPELLERS

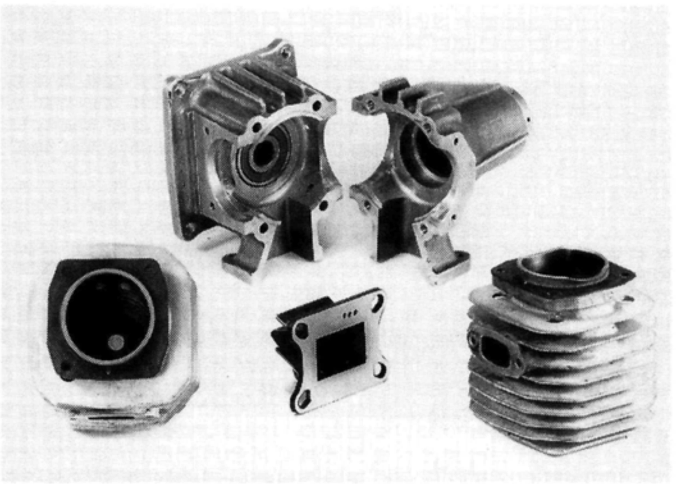
	Open exhaust	T. pipe @ 680/700mm
30x10 Menz	–	6,120
28x10 Glasner	–	6,180
24x16 Punctilio (drone)	–	6,240
26x12 Glasner	6,785	7,190
20x16 Punctilio (drone)	–	7,230
20x22 Glasner	6,700	7,200
24x10 Punctilio (drone)	–	7,394
24x12 Punctilio	–	7,480
24x10 Airflow	–	7,680
24x8 Airflow	–	7,880

PERFORMANCE EQUIVALENTS

	Open exhaust	T. pipe @ 780/800mm	T. pipe @ 580/600mm
B.hp/ci	1.80	1.53	2.05
B.hp/cc	0.11	0.094	0.125
B.hp/lb.	1.49	1.057	1.41
B.hp/kilo	3.30	2.33	3.11
Oz.-in./ci	241.00	269.70	241.00
Oz.-in/cc	14.70	16.46	14.70
Oz.-in/lb.	199.80	185.70	165.90
Newton meter/cc.	0.105	0.117	0.105
B.hp/sq. in. (frontal area)	0.43	0.366	0.490

Manufacturer: 3W-Modellmotoren GmbH, Frankfurt, Germany.

U.S distributor: Desert Aircraft, P.O. Box 18038, Tucson, AZ 85731; (520) 722-0607; fax (520) 722-0607.



Reed valve pyramid cluster is at center. Aluminum liners are by Kobenschmidt of Germany.

rigid base for the rest of the engine. Each cylinder/head block weighs 18 ounces, and the crankshaft (with rods) weighs 2.1 pounds.

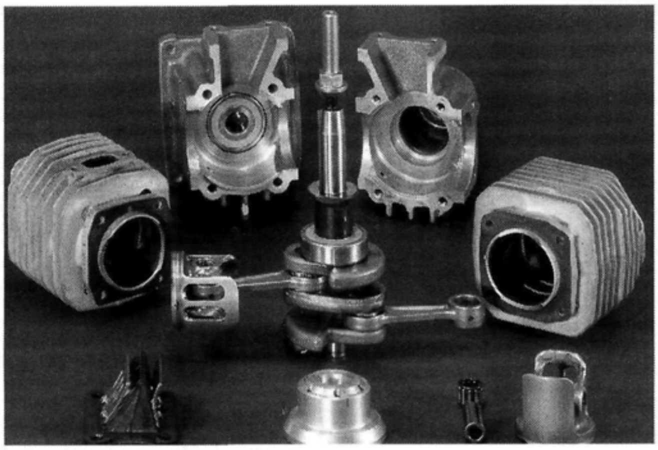
Those who are more used to engines of the usual sizes will find this one an eye-opener—clearly built for great reliability and running times of 1,000 hours or so. On the subject of vibration-free running, it's interesting that the distance between the rear radial mount and the nearer cylinder axis is only 2 inches, and the other cylinder axis is only 0.75 inch farther away. For a 7ci engine, that's a small overhang indeed, and its performance on the dynamometer was effortlessly smooth as a result.

The photos show a "skeletal" piston, but the crown is a robust 0.2 inch thick. The boost-transfer passage is formed in the cylinder wall and necessitates large cutaways in the piston wall to allow boost breathing. Transfer ports and passages are the usual Schnuerle style, and the 153-degree exhaust timing gives a fairly large, 18.5-degree blowdown period ahead of transfer to ensure good tuned-pipe performance.

The gap in the single, pinned, cast-iron piston ring is positioned within the boost port's central wall. Pyramid-style fiberglass reed valves (in a bank of four) are angled toward the direction of crankshaft rotation to maximize breathing; of course, they ensure correct induction timing irrespective of rpm.

3W 120B2

A thyristor-controlled electronic-ignition unit is provided with a pickup sensor and a small magnet mounted in the prop driver. The unit incorporates, as standard, 28 degrees of ignition advance by the time 4,000rpm are reached, of which 5 degrees are used when timing is retarded during idling. The sensor can be adjusted slightly, but varying it had little effect at full-load operation.



The 3W crankshaft is very robust, and the large counterbalances help to eliminate vibration.

PERFORMANCE

Following the manufacturer's suggestions, I shielded the carb's diaphragm air hole from the prop's air stream to prevent the fuel supply from varying. To accomplish this, flexible tubing supplies static air to the diaphragm hole from behind the engine.

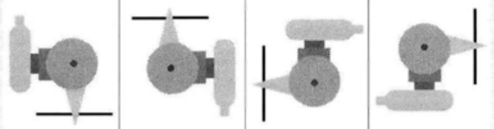
The engine I received for review had already been run in, so after a brief familiarization, I was soon checking prop rpm. With the 28x10 Glasner prop, to say that air movement was considerable would be an understatement! After all, the manufacturer claims up to 70 pounds of thrust.

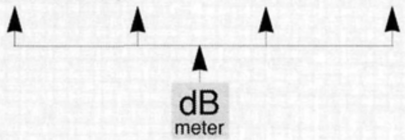
After tying down everything movable in the dyno area, I did further checks with a range of propellers, some of which are actually beefed-up versions of model props made by Punctilio in the UK for military drone use. Size for size, these generally take a heavier load, mainly owing to their thicker blade section. The largest propeller used in this test—the 30x10 Menz—is fairly popular in European pattern events because noise regulations are more easily met by the lower rpm and quiet tuned pipes generally used.

I tested the engine with a range of props that I thought were representative of the props fliers would typically use. I think lesser-load props than the ones I tried would allow higher horsepower figures to be reached; I suggest 19x19 props and short pipes for maximum racing power. For pattern use, I suggest a tuned pipe set at the length shown for the mid-range rpm area, i.e., 680 to 700mm or slightly longer.

Note: the tuned-pipe measurements shown on the graph refer to the pipes' lengths from the exhaust flange to the support ring around the middle/rear of the pipe. The pipes are different lengths because the manufacturer suggests that the cylinder nearest to the prop runs slightly richer and benefits from having a pipe that's 20mm longer than the other one. Because the offset between the cylinders is 20mm, this conveniently results in the rear ends of both pipes being at the same position.

It's also interesting to speculate on the probable effect of differing pipe lengths for either cylinder; because one cylinder has a different rpm/best-resonance point than the other, we might gain a wider useful power band, but pitched at a lower hp level; at the end of the effective power band, each cylinder acts as a "crutch" for the other's increasing deficiencies.

SOUND TESTS Decibel Readings					
Wind 8mph	30x10 Menz T. pipe @ 6,100rpm	113	108	108	108
9 feet AMA/USA	20x22 Glasner T. pipe @ 7,200rpm	110	103	108.5	108
	20x22 Glasner prop Open ex. @ 6,700rpm	116	119	112	113
	30x10 Menz T. pipe @ 6,100rpm	108	98	112.5	112.5
7 meters BMFA/UK	20x22 Glasner T. pipe @ 7,200rpm	103	98	102	102.5
	20x22 Glasner Open ex. @ 6,700rpm	111	113	106	108



Engine: 3W B120 with tuned pipes and open exhaust
Fuel: unleaded gas
Temp: 51°F
Humidity: 62%
Pressure: 974 millibars
Meter: Radio Shack type 33-2050 using GA601 calibrator set to NPL standard
Height: meter and engine set 1 meter above concrete surface
Location: outdoors, next to farmland

TESTING TIME

• **Test 1. Open exhaust.** *Fuel: unleaded gas with 2 percent Silkolene oil.*

This is the largest engine I've tested on my dyno, so first, I checked to ensure that the dyno would be able to cope with it. The engine produced a lot more torque than I expected, but not too much for the dyno (it's still ahead of the game!).

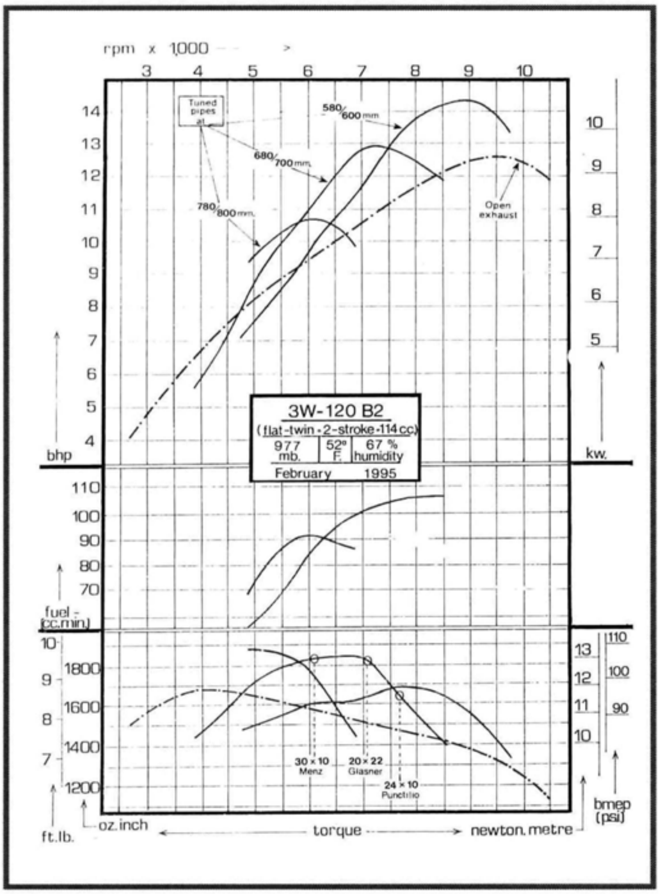
The 3W's smooth operation was a real help in the early stages of the calibrating and pre-loading necessary to see its very high torque—nearly 1,900 oz.-in. (The best torque figure was a modest 10 ft.-lb.!) The final figure for open-exhaust running was 12.58hp—easily verifiable and repeatable. The manufacturer claims a much lower figure of 10.5hp, but this is a theoretical and quite conservative estimate. In Germany, tests on a 3W 60cc single have yielded the same discrepancy. The torque/weight ratio was the highest I've ever recorded: 200 oz.-in/lb.—a significant performance parameter.

• **Tests 2, 3 and 4.** *With tuned pipes at three lengths.*

These light, well-constructed pipes with the twin exhaust manifolds and convoluted connectors add 1.75 pounds to bring the

engine/pipe's weight to 10 pounds, 2 ounces. In exchange for this extra weight, I saw a considerable increase in power and much reduction in sound level (as the dB chart and power graph show).

As I shortened the twin pipes progressively, rpm also rose to a point at which full pipe resonance and the consequent raising of hp values occurred. Naturally, this doesn't go on forever; mechanical limitations intrude, and the actual port timings themselves limit maximum rpm. The open-exhaust and rpm values are some guide, because it isn't usually productive (horsepower-wise) to take the best pipe resonance point much higher than the rpm point at which maximum horsepower is reached in open-exhaust form. (This is just a general finding from my tests so far.)



In any case, going for ever-shorter pipe lengths leads to increasingly smaller props being required, and a smaller prop isn't always suitable for a specific aircraft. In fact, the opposite is happening. Most people use tuned pipes to effect power increases below the maximum rpm area for open exhaust (partly to achieve lower noise levels, but also to allow the use of the larger-load props that are thought to be more efficient for certain applications).

• **Idling**. Using the 26x12 Glasner prop, 680 to 700mm tuned pipes, and the idle and high-end needles set at 1¼ turns out, the engine produced a steady low rpm of 1,380, which it held for many minutes. Recovery to full-throttle rpm of 6,480 was very swift and certain and proved what fine devices the industrial pumper carburetors are.

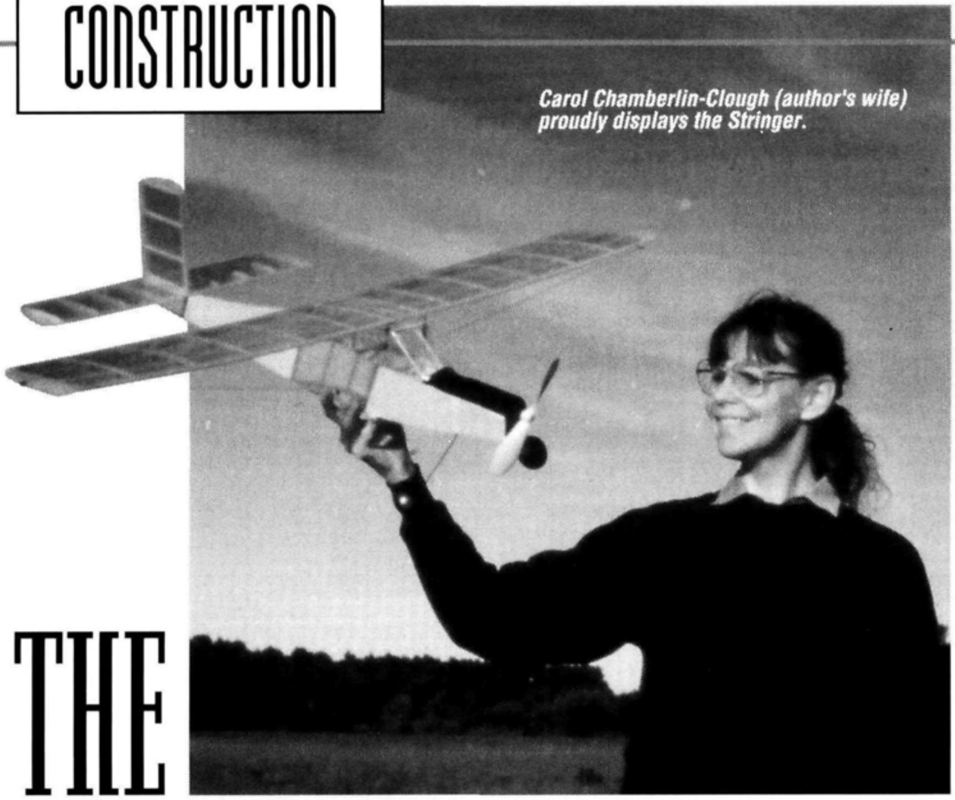
NOISE LEVELS

I checked the engine on a windy day at a distance of 9 feet. I didn't check at the European distance of 3 meters, but reducing the 9-foot values by around ½dB gives a very good approximation.

Toward the end of these checks, I remembered the connection between propeller and cylinder sizes as they affect cooling. An air-cooled multi-cylinder engine has less chance of being adequately cooled when it's running at full-bore on the ground; the cylinders just don't stick out as far into the prop's air stream as a single cylinder does. Most of the large props I use produce little meaningful airflow in the central disk area, and this semi-stagnant area is where the cylinders are; and the greater the number of cylinders, the worse the problem. After many minutes of ground running at full throttle, the 3W began to overheat and showed a reduction in rpm. And I have *re-learned* the lesson that these machines are clearly for *airborne* use and aren't basic stationary industrial engines!

From the photos, you should be able to tell that the 3W 120B2 is brutally functional, but the photos don't really do it justice. Whether such large model engines will one day be seen as lying within or without the definitions of what *model* engines are will depend on several factors. My experience with the 120B2 was certainly positive, and that has to be a good start. ■

CONSTRUCTION



Carol Chamberlin-Clough (author's wife) proudly displays the Stringer.

THE STRINGER

Flying à la Wright Brothers

by ROY L. CLOUGH JR.

WHEN YOU SHOW up at the field with the Stringer, people may politely remind you that you can't turn free-flighters loose in the R/C area. Excuse their mistake. With no visible control surfaces or an antenna, it certainly looks like a Cox PeeWee version of a cabin rubber model from the '30s. But when you launch it, it's obviously under control. Spectators are sure to demand an explanation.

It's simple. The Stringer uses Cox's* single-channel, rudder-only, Failsafe radio control—but not hooked up to a rudder. The Stringer is "aileron only"—minus ailerons. Control is by the early bird stratagem of wing warping. I followed Cox's instructions to "jumper out" the 1-second Failsafe mode to increase the holding time of control deflections.

When the idea first hit me, I thought I had a quick, easy, sure thing: a single-channel servo yanking on a couple of strings to warp a flexible wing. What could be simpler?

Simple? Let me tell you; the road to innovation is paved with open manholes. Before I got this "elegantly simple" concept to work, green leaves turned to red and yellow and then to brown and fell off the trees.

BIRTH OF AN IDEA

Stringer was spawned in the nostalgic doodles of old-time cabin rubber models such as Miss World's Fair, the Comet and Megow kits of the '30s. What set me off was fondly remembered, lightweight, stick-and-tissue construction, gracefully curved longerons and cellophane cabin windows; a multi-spar wing, lifting tail and fuselage strut work that was Warren-trussed against tightly wound rubber completed the fantasy.

But even as rubber-powered outlines flickered to life on my computer screen, several decades of accumulated inertia protested. Did I really want to haul my ancient bones through brush and swamp, chasing a runaway free-flighter? No way! Not when alternate power and a lightweight radio could be used to adapt it to "schoolyard" R/C. Then came the big inspiration: keep the *appearance* of a cabin free-flighter by omitting control surfaces, and steer it by warping the wings!

The size was right. At the 200-square-inch notch, there's a wide choice of powerplants: CO_2 engines, small electric motors and Cox's tiny wet engines. Power would be no problem. I grabbed a handful of balsa sticks and jumped, once again, into that yawning gulf between inspiration and fulfillment.

IF AT FIRST YOU DON'T SUCCEED...

I quickly built up the Stringer over DesignCAD 2-D printouts on cheap shelf-liner paper. I installed the Failsafe receiver and the geared electric powerplant from a Cox Flyboy. I carried it to the hayfield across the street, confident that I would toss it into the air and be rewarded for my ingenuity with a great performance. To record this latest Clough triumph, my wife Carol followed along with her unforgiving video camera.

I twiddled the stabilizer setting, got a decent glide, partly charged the battery, flipped switches and pushed the start button. A toss sent Stringer sailing straight out in a shallow climb. Terrific! Now for a right turn. Push the button. Push, push, push. Hmmm.... Nothing. The model flew on as straight as a stretched string. Well, half the fun of innovative model design is the surprises: try a left turn; the torque might help. It doesn't. No turn there either. Take some comfort, Clough: you can't control it, but that little bird is directionally stable!

Nice long walk to retrieve. Glad it was only a partial charge. Check the controls. The servo yanks trailing edges up and leading edges down just as it's supposed to. The wing warps OK in my hand; how about aloft? Another partial charge; another toss. Airborne, the wing twists noticeably in response to control inputs, but with no discernible effect. So much for quick and easy ideas.

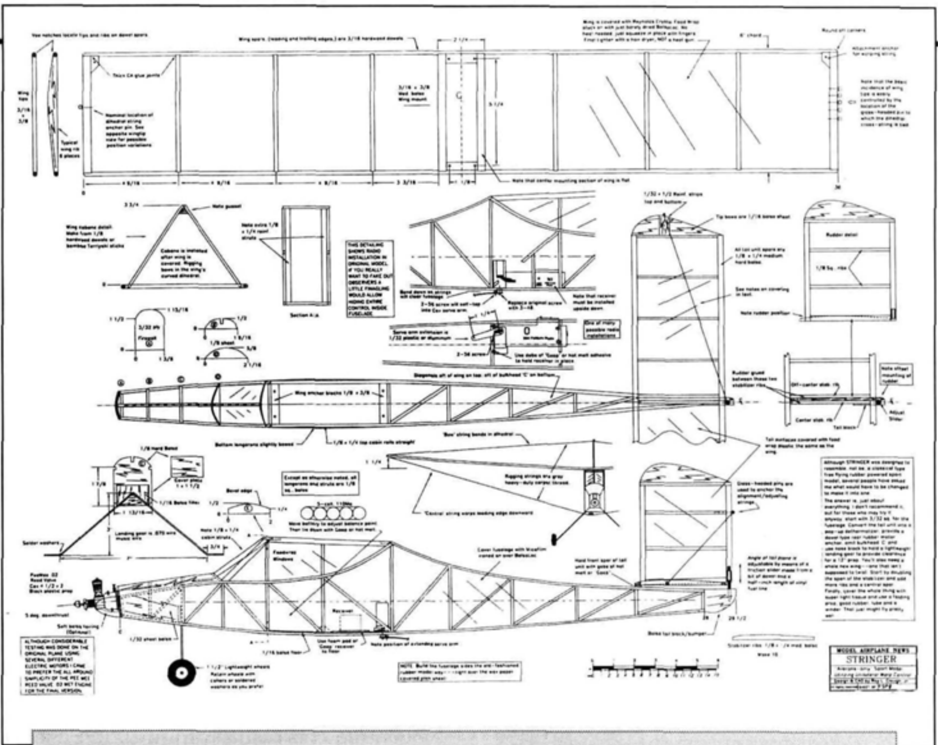
PHOTOS BY CAROL CHAMBERLIN-CLOUGH

Time to study Carol's videotape for clues. I find *none*, but somewhere in the middle of stop-motion frames, clearly showing twisted wings, I remember a similar problem had plagued the development of Paul MacReady's pedal-power Gossamer Condor. Increasing the angle of a wingtip hadn't raised the wing into a turn. The increased drag dropped it. Before Brian Allen (pilot of the Gossamer) could make those spectacular flights, they had to devise a way around the fact that things work differently at low speeds.

Increasing Stringer's wingtip incidence created more drag than lift—a condition analogous to "normal" low-speed aileron reversal. This should have turned it in the "wrong" direction, but the drag of the opposite down-twisted wingtip (which wanted to turn in the "right" direction), counteracted the turn. I mulled this over. Since the downturned wingtip produced enough of an effect to hold the model straight (despite the drag of the opposing wing's upturned tip), eliminating the drag of the opposite upturned wingtip should make it turn!

That called for re-stringing. String pulls were repositioned to affect *leading* edges only. The wingtip inside the turn was pulled down, but the opposite wingtip's incidence did not change; its pull string simply went slack.

It worked!



Stringer is a small schoolyard flier that uses unilateral wing warping for its control. It's an all-balsa construction model except for the hardwood-dowel leading and trailing edges. Designed by Roy L. Clough Jr. WS: 35.375"; L: 30"; engine: Cox .020; 1 or 2 channels; 1 sheet; LD 1. **$14.95**

ORDER THE FULL-SIZE PLAN...SEE PILOTS' MART

COMING UNGLUED!

Stringer turned handily in either direction. Drunk with the power of accomplishment, I yanked it all over the sky; but when I hauled it around sharply for a close-in video shot, the wing fell off!

It didn't take a board of inquiry to come to the conclusion that four glue spots, which would have held the wing on forever in free-flight, were no match for repeated yanking on the warping strings. I added heavy balsa cross-pieces to the cabin top and bulletproofed the wing mount with no. 2 screws in all corners.

Stringer was now nicely controlled, but the veteran Flyboy motor's performance could most kindly be described as "sedate." I hungered for more pizzazz, so I installed a Cox PeeWee reed-valve .020. Performance perked up. I swerved, turned, spiral-dived and let excess recovery speed carry the plane up and over into stall turns. Terrific!—until in an abrupt turn, the greater speed of the PeeWee converted half the multi-spar wing into a plastic bag full of shattered 1/8-inch-square wing spars. Stringer augered in.

I assembled a new wing, designed to endure "any amount" of twisting, using 3/16-inch hardwood dowel leading and trailing edges and 3/16-inch balsa wing ribs. Covered with stretchy food wrap, it easily withstands the most violent maneuvers.

Breakthrough: this simple expedient to control a single-channel plane finally paid off. Even at very low speeds, unlike ailerons or classical wing-warping, it never "reverses control." You call for a turn; you *get* a turn—all the way to the stalling point. You turn by *steering* a wingtip into a new path. This is rather a different matter from spoiling lift on one side and increasing it on the other. Stringer's success suggests further exploration of this principle.

The Why's of Wing Warping

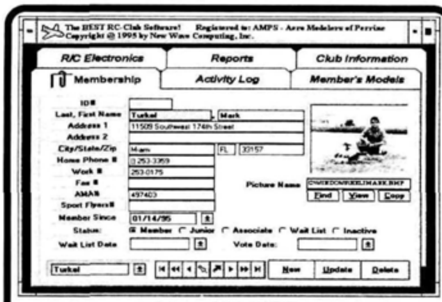
Wing warping: twisting a flexible wing "cross-corners" to increase lift on one side and decrease it on the other.

This was invented and patented by the Wright brothers. The idea supposedly originated when Orville, idly twisting the cover of a cardboard box during a conversation, suddenly realized that it suggested a simple way to obtain lateral control. The brothers resulting wing-warping invention led the way to the production of the first completely controllable aircraft. It was widely copied by other experimenters (with and without permission).

Like many apparently simple ideas, wing-warping presents some practical problems. Wings must be flexible enough to warp with manual controls, yet be stiff enough to carry flight loads. Their design boils down to a tradeoff between having reasonable control loads and structural integrity. There's also the aerodynamics problem rediscovered by Stringer: at low air speeds, bilateral warping can result in a reversed control response. Wing warping remained popular, especially in Europe, long after Glenn Curtiss and others had devised separate roll-control surfaces (ailerons). It survives to this day in hang gliders, parafoils, controllable kites and some experimental aircraft.

Stringer's control system is unique in that it is *unilateral warping,* and it works without reversal at any speed. Its success suggests that roll-control surfaces on the *leading* edges of rigid wings might be worth trying.

Think about it.



On this low flyby, the original Stringer's beautiful multi-spar wing is clearly visible through its transparent covering.

CONSTRUCTION

It's easier to make Stringer's curved longeron structure if you wet the sticks with white vinegar before bending them. (Some people use ammonia, but I feel a trace of acetic moisture sets up CA glue faster.) Notice the cut-to-shape form-fitting diagonals in the two bays aft of the cabin area. Sandwiched landing gear and motor bearers are good standard practice. On the bottom of the plane, there are diagonals from bulkhead C to the tail surfaces. Install the radio gear before you cover the plane. If you use one channel of a 2-channel receiver, instead of the Cox Failsafe, use a servo of "standard" size, such as a Futaba* S-148 instead of a micro- or mini-servo. Wing-warping imposes more load on the system. In either case, I suggest a 5-cell 110mA battery.

To cover the fuselage, I used Coverite's* opaque white Micafilm ironed on with Dave Brown* BalsaLoc. Use BalsaLoc to stick the Reynolds Crystal Color food wrap covering to the wing and tail surfaces. Do *not* iron this stuff. Just pinch it onto the semi-dried BalsaLoc and tighten it with a hair dryer—*not* a regular heat gun.

The wing is very strong. Ribs are made of rugged 3⁄16-inch-thick balsa and have a conventional section. Leading- and trailing-edge (TE) spars are 3⁄16 hardwood dowels. (I noticed no particular flight difference between the 3⁄16 dowel and the original's sharp-edge TE.) You could use the Plaid "tacky" glue sold in craft shops. It takes a little while to dry. The fastest wing assembly is achieved with small drops of quick-setting CA; then go over each joint with the tacky glue. Bowed-in "string dihedral" is a real winner. By moving the anchor pins back and forth, it is easy to match the wingtips' angles of incidence, and you can even crank in a slight washout for better stall behavior. The wing must be ruggedly attached to the fuselage. Don't omit the four no. 2 wood screws.

The lifting tailplane and untabbed rudder get the same string treatment—not for dihedral, but to center (or deflect) the rudder and keep the stabilizer straight.

Stabilizer incidence is controlled by sliding a CA'd piece of fuel line up and down a short length of dowel that's embedded in the tail block. Note that the rudder is offset to accommodate this arrangement; it makes no discernible difference. The front edge of the stabilizer/rudder assembly is held on the fuselage with dabs of hot-melt adhesive or Goop. Either will hold strongly but remain flexible enough to permit adjustments. The CG is a third of the way in from the leading edge. Note: even though the plans do not show it, you can make Stringer a 2-channel model by adding elevator. Also, a Cox TD .020 will really give it some zip.

PERFORMANCE

There's nothing quite as comforting as solid adjustments that are easy to alter. You have them with the bracing strings and tail slider. Don't trim the ship with the *control* strings. Install the strings without any appreciable sag or tension. I was initially tempted to adjust straight and level with the transmitter's trimmer. Don't! It will produce unequal turn response.

Concentrate on good basic adjustments. Don't be afraid of rudder-only (or, in this case, ailerons only) just because there is no "elevator trim" in the air. For all practical purposes, any protracted bank and turn is "down-" elevator. Start by trimming for a smooth power-off glide; then power up and turn it loose. The worst that can happen—a series of "tail-heavy" swoops—can be brought under control by alternately turning the model one way and then the other to keep the nose down until the engine dies. When your plane lands, make some adjustments and try again.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ■

Astro Flight News May 1995

Astro Goes Digital

Astro Flight has gone digital in a big way. We have developed two new proprietary eight bit digital micro-processor chips.

The AST-1001 Micro Chip

The AST1001 has a built in A to D converter,a 4MHZ Clock and 1Kbyte of internal memory. It is programmed for use in all of Astro's new line of Digital Peak Detecting Chargers. The advantage of digital technology is that all volt and amp readings are digitized and stored as numbers in computer memory. With digital storage all previous problems caused by temperature drift, or moisture and dirt accumulation which sometimes caused false peaks are no longer a problem. The AST1001 micro processor chip provides many more charging fuctions than the older analog designs and at the same time is more reliable and less expensive. Astro has released five new battery chargers using this chip.

The Astro Model 114D AC/DCDigital Peak Charger

Astro is proud to introduce its new Model 114D digital peak detecting charger. Designed to replace the older model 114 AC/DC timer charger. The model 114D is our economy version. It features a 400 ma trickle mode with peak detection and a five hour charge time limit. The fast charge mode is at a constant 4.5 amps with peak detection and a 45 minute time limit. This charger is primarily designed for the novice car racer, boat racer or airplane pilot who uses 6 and 7 cell nicads and an 05 size motor. The trickle charge can also be used to charge receiver and transmitter nicads. The charger is protected against reverse polarity on the 12 volt input side and short circuits on the nicad side.

The Astro Model 115D AC/DC Digital Peak Charger

The Model 115D is an upgrade from the 114D. It has all the same features as the 114D but also features an LED light bar amp indicator and a control so that fast charge current can be adjusted from 1 to 5 amps. This charger will charge any nicad battery containing from one to eight cells and with a cell capacity from 100 to 1700 mahr.

The Astro Model 116D DC/DC Digital Peak charger

The Model 116D is aimed at the car racer. It is set up for 12 Volts DC input power. The trickle rate is unchanged at 400ma but the fast charge rate is now adjustable from two to eight amps. An LED light bar ammeter is provided.

The Astro Model 110D DC/DC Digital Peak Charger

The Model 110D is designed for the advanced electric modeler who needs to charge nicad battery packs containing more than 8 cells. This charger will charge any nicad pack containing from one to eighteen cells. The Trickle charge and adjustable current features allow charging cells as small as 100 mahr and as large as 4000 mahr. A two line LCD alpha numeric display indicates nicad voltage, charging current, charging time, and milliamp hours of charge into the nicad.

The Astro model 111D AC/DC Digital Peak Charger

This charger has the same features as the model 110D but has the added feature that it can operate from 110 Volts AC as well as 12 Volts DC.

Peak Charger Features

Model	114	115	116	110	111
Min Cells	1	1	1	1	1
Max Cells	8	8	8	18	18
Trickle(ma)	400	400	400	400	400
Fast Amps	4.5	1-5	2-8	1-5	1-5
12 VDC	Yes	Yes	Yes	Y es	Yes
110VAC	Yes	Yes	No	No	Yes
A Display	No	Yes	Yes	Yes	Yes
V Display	No	No	No	Yes	Yes
Time Clock	No	No	No	Yes	Yes
Amp Hour	No	No	No	Yes	Yes
Retail $	89	109	89	159	199

The AST-2001 Micro Chip

The Ast-2001 Micro Chip is designed for electronic speed controls. This single micro processor takes the place of as many as sixty discrete components used in our older analog designs. This new digital technology lets us build a smaller lighter and more reliable and affordable speed control. All digital controls have added safety features like safe start and window. Safe start software does not allow your motor to suddenly start when the receiver is first turned on. For example, if your transmitter stick was set on high throttle when the receiver was turned on most analog controls would command full throttle. With SAFE START the motor will not be commanded to run until the throttle has been placed in off position and held in off for one second. When operating your model if your transmitter signal is interfered with you could get false throttle commands. Our window software will not allow any signal that is not normal to pass through the system and will shut down the motor if the incomming signal pulse width is too narrow or too wide.

Airplane Speed Controls

Model	204	205	210	211	217
Max Amps	50	50	45	75	30
Max Cells	36	36	16	14	14
"On" Fets	4	4	3	4	2
Brakes	No	Yes	No	Yes	No
Digital	Yes	Yes	Yes	Yes	No
Weight (gm)	30	30	20	25	15
Retail $	129	149	85	109	49

Car and Boat Speed Controls

Model	206	207	212	214	218
Use	Car	Boat	Boat	Boat	Car
Max Amps	75	50	50	30	15
Max Cells	20	36	14	14	5
"On" Fets	4	4	3	2	1
Brakes	Yes	No	No	No	Yes
BEC	No	No	Yes	Yes	Yes
Digital	Yes	Yes	Yes	Yes	Yes
Waterproof	No	Yes	Yes	Yes	No
Weight (gm)	25	35	28	28	18
Retail $	119	129	119	89	69

Electric Motor Handbook

Bob Boucher's Electric Motor Handbook is a must for the serious electric modeler. This book describes how electric motors work and how to measure motor characteristics like speed and torque and armature resistance. You will learn how to predict motor performance. There are chapters on motor timing, propeller selection, gearing, electronic speed controls, and nicad battery charging. Mechanical drawings and speed torque curves for every Astro plane and boat motor are also included. This book is must for the serious modeler. Suggested retail price $ 14.95

SCRATCH-BUILDERS' CORNER

ART SCHROEDER

HELPFUL HINTS AND TRICKS FOR BUILDING FROM PLANS

IF YOU'RE INTERESTED in building from plans or original drawings—scratch-building—you'll love this column. Construction techniques, building tips, plans analysis, readers' projects and question-and-answer sections are all possibilities. If the column is to succeed, however, I'll need lots of input from readers with an itch to build. I hope I can help you scratch that itch; let's hear from you.

SCRATCH-BUILDING DEFINED

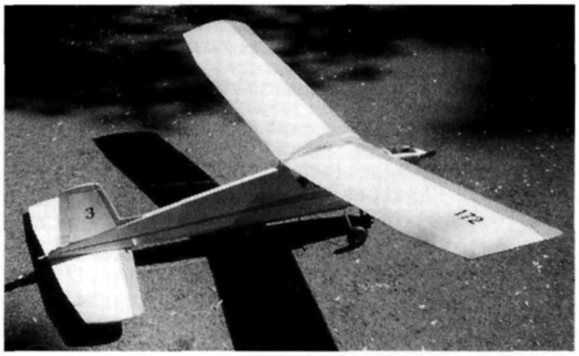
Scratch-building is building models from plans (either bought or your own originals), using raw materials, e.g., balsa-sheet stock, strips, sticks, plywood—whatever. The technique isn't difficult to learn, and it offers these definite advantages over kits.

• You're in total control; material selection is *your* responsibility. Whether you want the strength of hard balsa or prefer soft, easy-to-carve cowl and tip wood, it's your decision. You select all your wood to suit its purpose.

• Your pride soars as your model does, because you created your bird with basic, unprepared materials—not from a boxed kit!

• Your choice of projects increases. If you can't find that dream scale in a kit, but you find that *Model Airplane News* has a neat plan, go for it.

• When you cut your own parts, you have a perfect fit (or you *should!*).



PHOTOS BY ART SCHROEDER

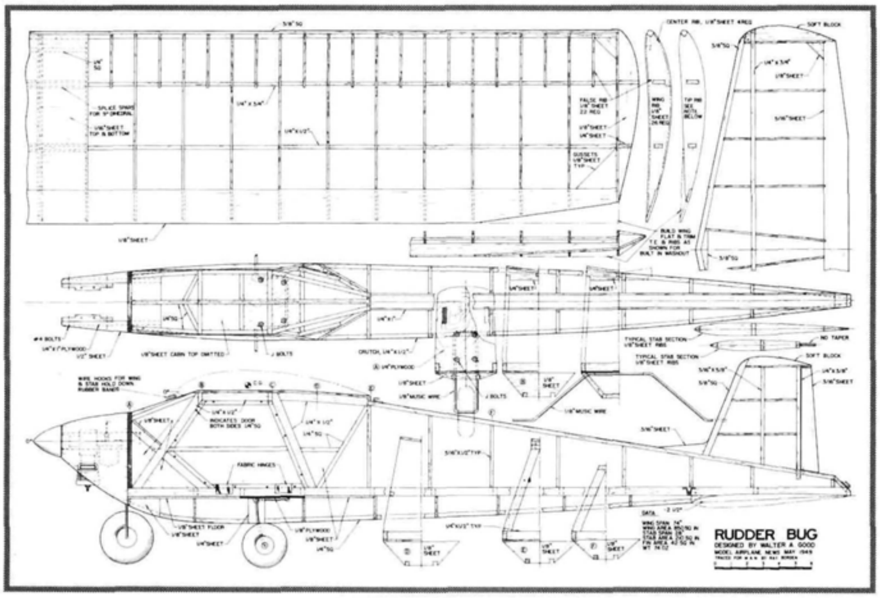
The Rudder Bug was one of the first models designed strictly for R/C. Its free-flight heritage is obvious, but the structure is much more rugged. Note the triangular rear cross-section.

BECOME A DESIGNER!

You can try your own ideas. Draw some basic lines, pore over old magazines, and find out what works for others. Steal a fuselage style here, pilfer an airfoil there, snatch a construction style, cop a surface-area setup, and then add your own curved lines. Presto chango! You have your own, original design.

What's the downside to scratch-building? Other than a little extra work, the only thing I can think of is the loss of your right to berate your kit's manufacturer for a crummy parts fit or poor balsa. That can be really frustrating!

Although many argue that building from kits is the most popular way to obtain an airframe, I think the greatest satisfaction comes from scratch-building.



RUDDER BUG

When I needed something to fly at the Vintage R/C Society's first re-creation of the famed Selinsgrove affairs (originally held in the '50s), I built a "scratch" airframe that became very popular. I selected the *Model Airplane News'* plan for the Walt Good-designed, late '40s, R/C Rudder Bug (plan no. FSP11791). This high-wing design is intended exclusively for radio operation, and it has a different look. It's known to be a solid flying bird and, most important, it *isn't* available as a kit.

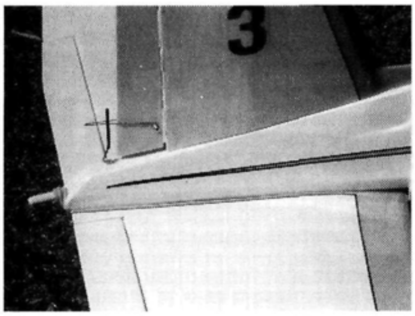
The Rudder Bug poses some problems for neophyte scratch-builders. The accompanying article (*Model Airplane News* now includes reprints of construction articles with all plans!), though interesting with respect to design development, doesn't offer a lot of building help. That was true of most articles in the '30s and '40s, because it was


The Rudder Bug's large doors allow easy access to the radio, the tank and the ignition system. Power is a 1940 Delong 30 ignition engine with a variable carb for speed control. The APC prop seems out of place, but it works beautifully.*

assumed that only *experts* would build from these plans. (I wonder where all the "experts" came from!) The article is of little help, particularly for builders who are accustomed to the fantastic instruction books that come with today's kits.

Some of the construction techniques for the Bug are no longer widely used, e.g., crutch fuselage, inset wing spars and functioning fuselage doors, so they might seem strange to relative newcomers. Of course, old-timers will find everything familiar. The Rudder Bug isn't difficult to build—just different; but it isn't well-supported with instructions.

I'll be happy to correspond with anyone who wants to take a crack at this unique old-time R/C. By the way, it's one of the easiest R/C airplanes to fly (it's almost impossible to get into trouble with it), and it's very rugged. I was a coward, however; I added a small elevator (I've forgotten how to fly a rudder-only airplane, I guess), which enables me to do maneuvers that amaze the new fliers at my field. I'll outline some salient construction points here, but if there's enough interest, I'll prepare a full-blown set of instructions to go with the original article. Let me know.


I added elevators as a precaution against trim problems. They make the Rudder Bug more maneuverable. Note the hairpin rudder connection—typical OT radio practice.

PAST SUCCESSES

I built two Rudder Bugs back in '51. They were the best-built and best-finished projects I had completed to that date—gorgeous in white silk, a clear, doped finish and green trim with a gold pinstripe. Both flew like birds for exactly 30 seconds before their wings folded. I was heartbroken, and my latest Bug is an attempt to heal that 40-year-old cardiac wound.

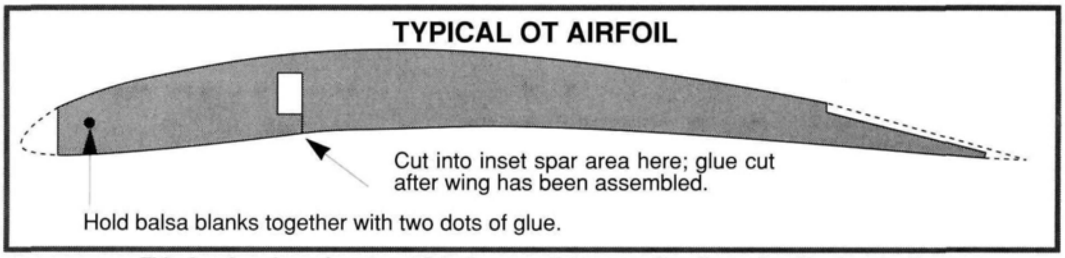
ONWARD AND UPWARD

The Bug's crutch-based fuselage is a study in angles; the fuselage's upper half is erected (bridge style) on the crutch, which is pinned to the building board. You have to be accurate when cutting the mostly 1/2x1/4-inch basic balsa stock, and a few simple side jigs make things more precise. The spruce used for the basic crutch and the two angled vertical uprights that form the cabin-door openings add immeasurably to the airframe's strength without inflicting a big weight penalty.

For the crutch and wing spars, I used spruce instead of the specified balsa. This baby won't shed its wings in 30 seconds! I bought 1/8-inch-thick spruce and planned to laminate two pieces together to obtain the 1/4-inch thickness I needed. Then I hit on the idea of making a composite member by sandwiching a length of 0.6-ounce fiberglass cloth between the two pieces of spruce. I used thin CA for this, and the resulting parts are strong enough to hold up the George Washington Bridge (OK, maybe only the Brooklyn Bridge!). With the laminate made, I trimmed off the excess fiberglass and lightly sanded the edges of the spar and longeron. I *guarantee* the spars won't break during any maneuver the Rudder Bug can do. Give the technique a try; it's great!

RIB-CUTTING HINTS

Cut the Bug's ribs out of stacked pieces of balsa that are a little larger than you need for the ribs. For stability while you cut, glue them together, but use only two tiny drops of glue (Ambroid, Duco, or the like) so they can be easily separated later. I cut two 1/8-inch plywood templates (aluminum or Micarta are also good for templates), and placed the ply templates on the top and the bottom of the stack. To avoid "slanting" the stack slightly and making the bottom rib a different size, use both templates (instead of only one on top of the stack).



This drawing shows how to cut into the spar slot to expedite rib construction (see text).

It's easy to cut out many ribs simultaneously on a jigsaw or a band saw. The tough part of rib cutting for a model like the Rudder Bug is that wing construc-

tion involves inset spars. The usual procedure has you drill an entry hole in the center of the rectangular spar cutout, then slip the jigsaw blade into the hole to cut out the rest of the rectangle. But I think it's easier to cut from the rib's edge directly into the area to be cut out (see sketch). When you assemble the wing, re-seal the cut with a drop of CA, and no strength will be lost.

After having cut out the ribs, use an X-Acto blade to separate them; they'll snap loose easily if you used only tiny dots of glue earlier. This method is much better than using bolts or pins to hold a stack of blanks.

Ribs can be made of any material: foam and corrugated cardboard are great, and even very thin balsa is acceptable in most R/C airplanes. I used 1/16-inch balsa instead of the 1/8-inch called for on the Bug's plans. The only thing you should never skimp on when you build a wing is spar material, and I strongly recommend spruce instead of the suggested balsa.

After you've cut out the ribs, you've done most of the sheet cutting that's necessary. There's a plywood firewall and eight simple formers; the rest is all sticks, and there are a lot of them. It's therefore quite easy to "assemble a kit" for a Rudder Bug, and that really is the way to start any scratch-building project.

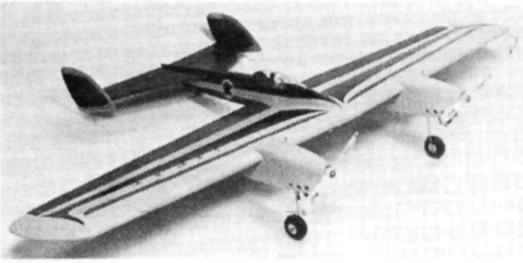
NECESSARY TOOLS

You can cut out parts with a knife and, after using the two-template method, you can carve and sand the ribs to shape. Power tools do, however, make life easier and produce very satisfying results. I cut out 90 percent of my parts on a Delta, 15-inch scroll saw (part no. 1340225). It has a cast and ground surface table, a 15-inch depth of cut with a 2-inch throat cut and a powerful, heavy-duty motor. I bought mine at a discount center for about $160, and it has improved my building experiences immeasurably. Over the coming months, I'll clue you in on some of the other tools I use.

PLANS PICK

One airplane has been "gnawing" at me for a decade now, and I've chosen it as this month's "Plans Pick." It's the Blackhawk (*Model Airplane News* plan no. FSP12802)—a twin .049-powered "ukie"! Whoa! Before you get the idea that ol' Schroeder has lost his mind—recommending a 1/2A ukie to an R/C crowd—hear me out.

The Blackhawk has the most appealing lines I've seen for a long, long time. It was designed by Cal Shumate and, though I'm sure this gifted designer never intended it to be so, a Blackhawk at twice its intended size would make a great twin-engine sport plane on two 40s. Doubling the size of the existing plan would give the plane a wingspan of nearly 73 inches; the original's zero-zero setup could be retained, and even the existing symmetrical airfoil (perhaps slimmed to about 15 percent) would be good for R/C. In fact, I wouldn't modify its construction very much; I'd just increase material sizes, make the wing removable and set the bird up for rear folding retracts.



First published in the December '80, the Blackhawk was a twin 1/2A control-line stunter. At twice its intended size, it would make a good-looking twin .40 sport R/C airplane.

It would be a simple matter to send the plans to an enlarging service, thereby saving any drawing and scale-up time. This one would definitely be a real showstopper at any field, and I guarantee that you wouldn't have a typical "cookie cutter" airplane. That's one of the best reasons I can think of for entering this wonderful world of scratchin'! See ya!

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ■

GOLDEN AGE OF R/C

HAL DeBOLT

"NEWFANGLED" ADVANCES IN R/C

APPARENTLY, I struck a welcome chord with my recent coverage of the Berkeley Aerotrol R/C system. The advent of Aerotrol was opportune: it got many of us radio neophytes started in R/C, maybe because it appealed to our pioneering natures. After free-flight and CL activity, many dreamed of the day when they could get rid of the "lines" and fly as they wished without fear of "losing it." Price was also an incentive; most willingly gambled $50 to see whether their "dream days" had arrived! The results of the gamble were mixed: some did well and others had mediocre results. But, even in the worst cases, the spark was lit. The Aerotrol experience led to more sophisticated systems that came onto the market almost daily.

I won't beleaguer you by using our experience as an example, except to say that my first flights were with Aerotrol, which served very well considering that I knew nothing but basic electronics. Within weeks, I was doing wonders (for the time) with the modern-style C-S 465 system; all you had to do was plug in the batteries, switch it on and fly—just what was needed to expand R/C!

TRAINER NOTES

Wayne Westra of Allen Park, MI, provided some complimentary Aerotrol feedback. A true OT'er, Wayne tells us that, intrigued as he was by the newfangled advances in R/C, he purchased a LW Trainer, an Aerotrol system and an OK Cub .09—total bill: $125! Success with the Aerotrol/Trainer combo led to a Lorenz two-tuber, then to a "hard tube" receiver (all of which used escapements) and finally to the Galloping Ghost system. The Trainer survived them all!

In those days, several long Aerotrol flights would often end with radio failure. I should say that early radios required "B" (plate), "A" (filament) and escapement batteries. Wayne informs us that his solution to the longevity problem came from a "ham" friend who advised him to double the "B" battery supply; the added capacity allowed extended flights without failure.

AERO SPARK COIL COMPANY R&D

John Worth fills us in about obscure pre-Berkeley Aerotrol history. John indicates that he was first introduced to Ed Lorenz in 1947 by Al Lewis—then editor of *Air Trails* magazine and the same Al Lewis who did so much for the early AMA.

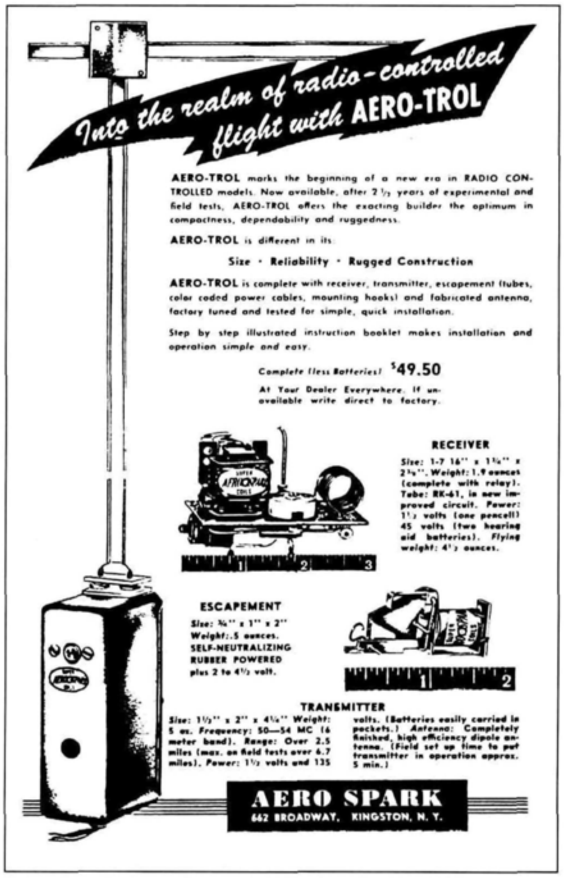
At the time, Lorenz was employed by the Aero Spark Coil Co., which was a leading producer of coils for our engine-ignition systems. Recall that these ignition systems were similar to those on early cars. They had a spark plug that required high voltage to fire under compression. To fill that need, a battery fed electricity through a set of contacts (points) to power the voltage-amplifying coil that fed the spark plug. The points were opened and closed by the engine crankshaft so that ignition occurred at the desired time. There was also a condenser across the points to control any "arcing."

As is usual for model use, we needed a lightweight, powerful coil (regular coils could weigh 1 pound or more!). The Aero Spark product met our needs nicely. Apparently, Aero Spark wanted to diversify its product line, so they put Lorenz to work developing a viable commercial R/C system. After a 2½-year development period, they offered the Aerotrol system as a way to fly R/C. Unfortunately, this was long before the "Citizen 27MHz band," so they were forced to use the 6-meter ham band, which required an operator's license that was hard to obtain; this proved a handicap to sales.

AHEAD OF ITS TIME

John Worth also suggests that perhaps the Aerotrol was a bit too early for the market. The mainstay of Aero Spark was its ignition coils; the advent of the glow plug brought the demise of the company. Ed Lorenz went on to enjoy a long tenure with IBM. Berkeley Models acquired Aerotrol and their release proved much more timely.

To this day, the flying weight of the



The 1948 Aero Spark Coil Co. ad announces the Aerotrol R/C system.

HITTING THE BULL'S-EYE

Is there an OT'er who hasn't had a Taurus or at least had the opportunity to fly one? When Top Flight introduced this delightful Ed Kazmirski design, it was very widely accepted. Tauruses littered the R/C fields from coast to coast and were flown successfully in the hands of any accomplished pilot.

Its origin is a sign of those times. Kaz was the world champion at the peak of his reign. R/C pattern was evolving, and Ed was looking for a way to improve upon his world champ Orion. His solution was very different; the only resemblance to the Orion was the low wing. Ed's Taurus concept was unique and very different from the norm, then and now.

World Champion Ed Kazmirski, with his Nats-winning Taurus.

Note the abnormally thick wing used on the Taurus, plus the Lee-Veco .45 engine.

The aerodynamicists tell us that the way to improve efficiency is to reduce the negative and/or increase the positive forces (for instance, drag is a negative force). The Taurus was a design for reed equipment in which slower flight is an advantage. Kaz obviously had this in mind.

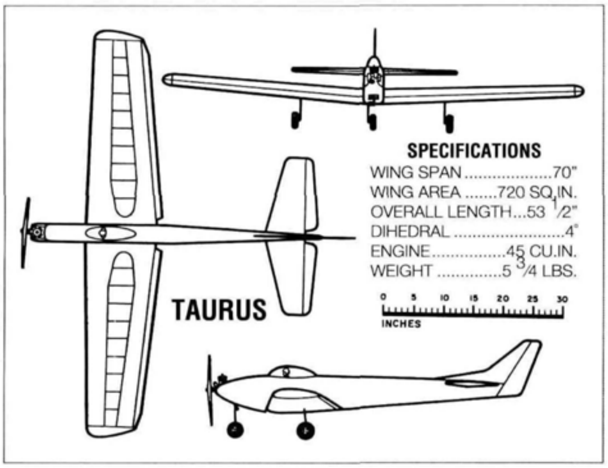
While others were making a great effort to reduce drag, Ed deliberately increased it! But he did so on the wing where the application of his concept would yield lift as well as drag.

The backbone of the Taurus design was the grossly thick NACA 2418 airfoil that was used from wing root to tip. This much thicker foil reduced flying speed while it added the needed lift for maneuvers at a lower speed. Obviously, the approach was successful; Kaz and the Taurus became our '61 Nats champ!

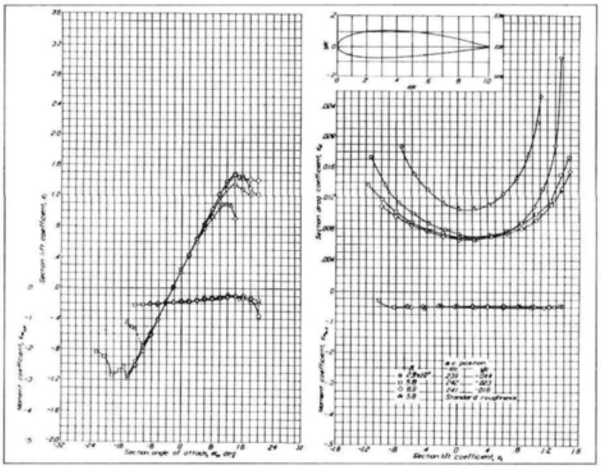
A flying feature that Ed expounded on was the Taurus landing approach. Naturally, the added drag required all available power for maneuvers; but, with reduced power, the drag (plus generous lift) produced slow flight à la flap effect. Ed's demonstration went like this: start from a ridiculously high landing approach, then point the nose down at the landing spot and reach it with very little speed buildup to achieve a picture-pretty sit-down. Impressive!

Another feature of the Taurus was its drastically swept-back vertical tail, which included the rudder hinge line. Note that in the air, rudder was only used for "spin style" maneuvers. Ed's philosophy was that the slanted rudder not only provided yaw control, but it also provided some elevator effect that added to the spin capability.

In its day and with reed systems, the Taurus proved to be one of the most docile and most maneuverable flying designs—a most desirable combination. The question could be: why not today, also, instead of the "missile" types now in favor? A delightful OT'er for your stable, anyone?



The Kazmirski Top Flite Taurus—a 3-view.



The high-drag, high-lift 2418 airfoil used on the Taurus.

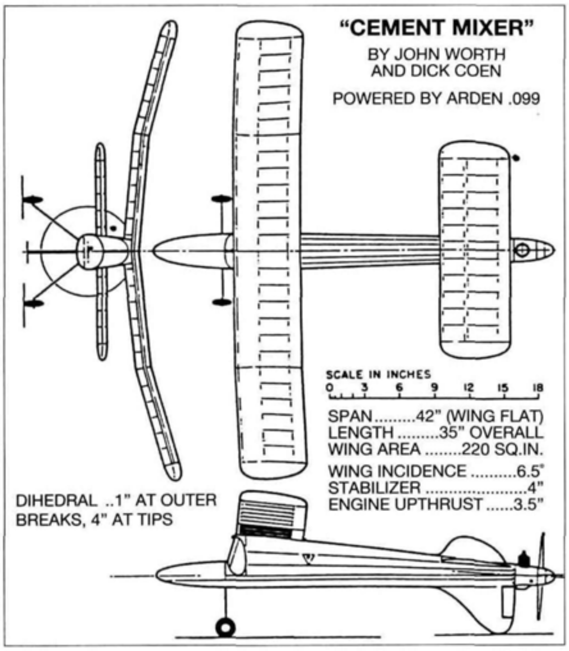
Aerotrol system can be regarded as outstanding. The receiver and batteries weighed only $4\frac{1}{2}$ ounces. Add another 3 ounces for the escapement and batteries, and the total is still less than $\frac{1}{2}$ pound—very usable! Of course, you must realize that this provided only one control channel, but compared with other systems of that day, it was outstanding.

Given today's sophisticated radios, multiple transistors, integrated circuit chips, Ni-Cds, etc., it's amazing that we were able to fly successfully with such a rudimentary radio. It used just one weak-hearted tube; time does create the better! Do you recall "crystal" receivers?

John concludes his Aerotrol input with a cute story. The Aerotrol system was revolutionary for the time in that all the other commercial systems (very few) were much heavier. Al Lewis of *Air Trails* recognized this as an R/C breakthrough and thought it should be publicized. He wanted to feature a report on it, and he needed a successful model design to use with it. For the model, he turned to John (who was on the cutting edge of R/C at that time). John must have been really exuberant about the project because instead of a simple, bread-and-butter design, his response was the Cement Mixer, which seems exotic even today. John was obviously influenced by the revolutionary Mix Master bomber, which was then setting all kinds of records (weren't we all?). As we have seen, for an OT R/C project, John has since replicated the Cement Mixer, the only change being to use electric power instead of an engine.

Control Research responded to the early desire for radio interchangeability with this "canned" version of the popular Lorenz two-tuber. You just plugged it in!

Apparently, John was also introduced to the tribulations of writing magazine articles with this project. He found that inking drawings was an art in itself. He had to re-do the drawings four times before Al Lewis felt they were ready for publication! Is anything ever simple?



John Worth's outstanding Cement Mixer from the early days. John was obviously influenced by the revolutionary Mix Master bomber, which was setting records at that time.

Otherwise, in those early days, John Worth and Ed Lorenz organized the Control Research Co., which marketed Ed's two-tube receiver and many other items. In those days, there was a desire to make radios interchangeable between models; for example, the LW "removable R/C unit." Control Research's response to the need was to stuff the two-tube receiver into an available "IF can" which could then be plugged in much like a tube! Ingenious?

And so it was. Do remember that this is *your* OT R/C place! ■

INDEX OF MANUFACTURERS

Aerotech Models, 2740 31st Ave. S, Minneapolis, MN 55406; (612) 721-1285.

Aerotelemetry, 947 W. 30th St., #24, Los Angeles, CA 90007; (213) 746-9380.

Air Hobbies, 1621 Liberty Ridge Rd., Concord, NC 28025; phone and fax (704) 788-9042.

Airtronics Inc., 11 Autry, Irvine, CA 92718; (714) 830-8769.

American Small Business Computers, 1 American Way, Pryor, OK 74361-8801; (918) 825-7555; fax (918) 825-6359.

Astro Flight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

APC Props; distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645; (916) 661-6515.

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Condor R/C Specialties, 1733 Monrovia Ave. Unit G, Costa Mesa, CA 92627; (714) 979-8948.

Coverite, 420 Babylon Rd., Horsham, PA 19044; (215) 672-6720; fax (215) 672-9801.

Cox Hobbies, 350 W. Rincon St., Corona CA 91720; (909) 278-7282; fax (909) 278-2981.

DAD (Design & Development Corp.), 168 Main St., P.O. Box 711, Chadron, NE 69337; (800) 669-4548 (orders only); (308) 432-2122; fax (308) 432-2002.

Dave Brown Products Inc., 4560 Layhigh Rd., Hamilton, OH 45013; (513) 738-1576; fax (513) 738-0152.

Desert Aircraft, P.O. Box 18038, Tucson, AZ 85731; phone/fax (602) 722-0607.

DGA Designs, 16 Main St., Phelps, NV 14532; (315) 548-3779.

Du-Bro Products, 480 Bonner Rd., P.O. Box 815, Wauconda, IL 60084; (708) 526-2136; fax (708) 526-1604.

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Hot Stuff; distributed by Satellite City, P.O. Box 836, Simi Valley, CA 93062; (805) 583-0994.

Indy R/C Sales Inc., 10620 N. College Ave., Indianapolis, IN 46280; (317) 846-0766.

Jet Hangar Hobbies, 10595 Bloomfield Ave., Los Alamitos, CA 90720; (310) 429-1244; fax (310) 429-6648.

Jet Model Products, 211 N. Mullen Rd, Belton, MO 64012; (816) 331-0356.

JR Remote Control; distributed by Horizon Hobby Distributors (see address above).

Lanier R/C, P.O. Box 458, Oakwood, GA 30566; (404) 532-6401; fax (404) 532-2163.

Master Airscrew; manufactured by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386.

MAT; distributed by R&R Distributors, P.O. Box 144, Wood Ridge, NJ 07075; (201) 804-0077.

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Newman Optics, 5083 Ridgedale Dr., Ogden, UT 84403; (801) 479-7733.

Northeast Sailplane Products, 16 Kirby Ln., Williston, VT 05495.

O.S.; distributed by Great Planes Model Distributors (see address above).

Pica/Robbe, 2655 N.E. 188 St., Miami, FL 33180; (305) 932-1575; fax(305) 937-2322.

Precision Aviation Design, 1822 6th Ave. W, Bradenton, FL 34205.

Quadra; distributed by Quadra-Aerrow Inc., P.O. Box 183, 1881 Rogers Rd., Perth, Ontario, Canada K7H 3E3.

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Thunder Tiger USA, 2430 Lacy Ln., #120 Dallas, TX 75006; (214) 243-8238; fax (214) 243-8255.

Top Flite; distributed by Great Planes Model Distributors (see address above).

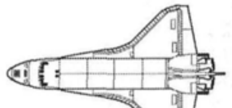
Tru-Turn, P.O. Box 836, South Houston, TX 77587; (713) 943-1867.

Ultracote; distributed by Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651.

U.S. AirCore Inc., 4576 Claire Chennault, Hangar 7, Dallas, TX 75248; (214) 250-1914.

Vailly Aviation, 18 Oakdale Ave., Farmingville, NY 11738; (516) 732-4715.

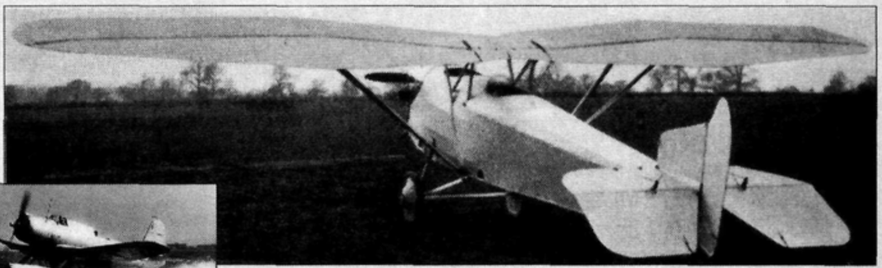
Zinger; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.



NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



CONGRATULATIONS to Bill Mikesell of South Elgin, IL, for correctly identifying the May '95 mystery plane. The Chance Vought SB2U-3 Vindicator was an XSB2U-1(0779) that was converted into an experimental floatplane in 1939—the only one of its kind. The SB2U-3—a two-place scout and dive bomber—had a subfin to help control it in the water. The seaplane version's specs were: span—41 feet, 11 inches; length—13 feet, 3 inches; height—11 feet, 8 inches; wing area—305 square feet; empty weight—5,719 pounds; gross weight—7,427 pounds; wing loading—18.7 pounds per square foot; power loading—10.9 pounds per 1hp.

Constructed of aluminum, steel tubing and fabric, the SB2U-3 was powered by a Pratt & Whitney R-1535 Twin Wasp Jr.—a 14-cylinder air-cooled radial that produced 825hp at 2,630rpm (sea level). Its top speed was 204mph; it cruised at 125mph; stall speed (with flaps) was 71mph; and it climbed at 890 feet per minute to its service ceiling of 20,800 feet.

Thanks to all who wrote in; good luck next month!

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

THE RIYADH MODEL FLYING CLUB OF THE KINGDOM OF SAUDI ARABIA

c/o Robert S. Hodes, American Embassy—IRS, Unit 61307, APO AE 09803-1307

Founded in 1992, this club's purpose was (and is) to promote safe flying. Member Robert Hodes remarks that before the club's existence, "Attending a typical flying session was akin to being present during a Scud raid." Now the members are more safety-conscious and are required to have liability insurance.

Twenty modelers from Saudi Arabia, the U.S., Britain and Canada make up the club's current roster, although membership fluctuates as expatriate modelers come and go. Thus far, they have sponsored an endurance contest that took place over three months and featured .049-powered gliders and regular non-powered gliders; a contest for the best-built/best-looking plane of any type; and an aerobatics competition that was loosely based on the AMA Novice and Sportsman classes.

The Riyadh fliers' biggest problem is the scarcity of modeling supplies; everything must be shipped in or carried in by hand. The club members make their own fuel out of castor oil and solvent alcohol, and Robert says, "We help one another out. No one throws anything away, so someone is almost always able to come through with some badly needed piece of hardware."

For their resourcefulness, fellowship and efforts to promote safe flying, we award the Riyadh Model Flying Club two complimentary subscriptions to *Model Airplane News*. Congratulations. ■

ADVERTISER INDEX

PRODUCT NEWS

DAVE BROWN PRODUCTS
The Hangar

This expansion module, which gives the user the ability to accurately simulate the flights of more than 280 models, works only with release 4 of Dave Brown's R/C Flight Simulator. Eleven categories are available: trainers, intermediates, sport, pylon racers, pattern, fun-fly, ducted-fan, gliders, biplanes, scale and semi-scale. All the models included in the Hangar are available as kits and from plans services.

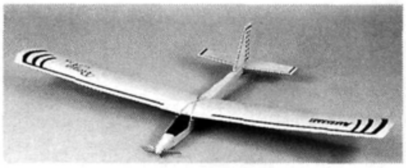
Price—$24.95.

Dave Brown Products Inc., 4560 Layhigh Rd., Hamilton, OH 45013-9200; (513) 738-1576; fax (513) 738-0152.

GRAPHICS PLUS
Vinyl Numbers & Letters

These custom, computer-cut vinyl markings can be used on any model. Available in 22 colors (including MonoKote matching colors) and 1,500 standard font styles, these markings are perfect for creating multicolor graphics, spray-painting masks, or for displaying AMA numbers. All markings are supplied on carrier paper for easy peel-and-stick application. Customized graphics can be scanned in to duplicate your markings. The 1½-inch-high AMA numbers and letters are 35 cents each.

Graphics Plus, P.O. Box 106, Waterbury, CT 06720; (203) 756-9488.



AEROCRAFT
Begin-Aire

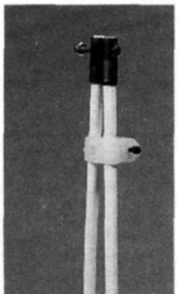
This electric sailplane is suited to novice and expert pilots. Graupner's Speed 400 Series motor, running on a 5- or 6-cell Ni-Cd battery pack, powers the craft. Kit features include precision machine- and die-cut parts from select balsa and plywood, full-size plans, a generous hardware pack, a formed-plastic motor cowl and an illustrated instruction manual. Specifications: wingspan—68 inches; wing area—475 square inches; weight—23 to 26 ounces; radio—3-channel.

Price—$42.95.

Aerocraft, P.O. Box 553, East Northport, NY 11731; (516) 754-6628; fax (516) 253-3001.

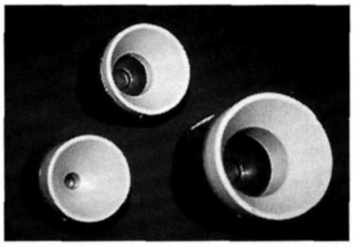
GILBERT AIRCRAFT PERFORMANCE PRODUCTS
Fun-Fly Landing Gear

This landing gear is used by NCFFA Masters class fliers more than any other ready-made gear, and it's used by more NCFFA Masters class champions than any other gear. With the axle, it weighs 1.5 ounces, and it's ready to be bolted onto your plane.



Price—$10.

Gilbert Aircraft Performance Products, 123 Goodrich St., Zeeland, MI 49464; (616) 772-1832.

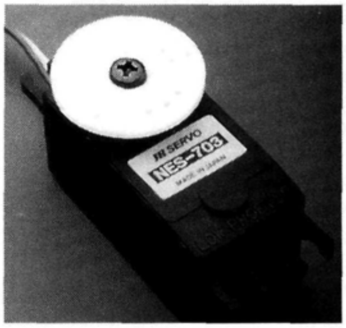


MILLER R/C PRODUCTS
Big Grip Starting-Cup Inserts

Engineered to fit large nose cones, these starting-cup inserts are made out of black-anodized aluminum. They're available in 3-, 3½- and 4-inch sizes, and they have a rubber insert. If you're designing your own starter system, Big Grips come machined to match your starter or blank so that you can machine them.

Price—$46.95 to $132.95.

Miller R/C Products, P.O. Box 425, 159 Green St., Kenwood, CA 95452; (707) 833-5905; fax (707) 833-0059.



JR REMOTE CONTROL
Updated 703 Retract Servo

A machined brass gear train makes the 703 servo stronger than ever. Specifications: torque—93.2 oz.-in.; speed—1.36 seconds per 160 degrees; weight—1.16 ounce.; dimensions—0.88x1.73x0.93 inches.

Part no.—JRPS703; **price**—$89.95.

JR Remote Control; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

PRODUCT NEWS

TOP FLITE

Gold Edition P-51 Mustang

To celebrate the 20th anniversary of Top Flite's P-51B Mustang, this updated, CAD version re-creates the full-size "Shangri La" in detail. A limited number of these kits are available, and each is numbered and comes with a certificate of authenticity signed by the designer, David Ribbe. Color decals and all the parts needed for the B-series turtle deck are included in the full kit, and the conversion package has all the parts needed to convert Top Flite's P-51D Mustang into a scale P-51B model.

Part nos.—TOPA0111 (kit); TOPA1615 (conversion).

Prices—$259.99; $34.99.

Top Flite; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61825-9021; (217) 398-3630, fax (217) 398-0008.

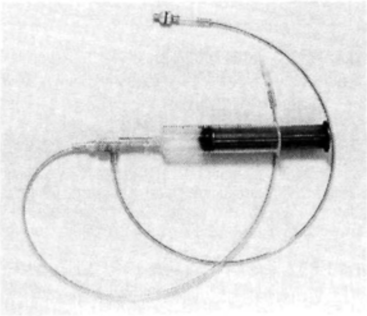
ELFTMANN BROTHERS

Sure Start

This engine starter is guaranteed to start any .15- to .90-size R/C airplane quickly and easily. The 2.75-pound aluminum starter is 12 inches long and 1.75 inches wide, and its head and body are knurled to ensure a good grip. To operate it, you simply turn the head four to eight complete turns (depending on the size of the engine) and press the head against the nose cone. It has a lifetime guarantee.

Price—$79.95.

Elftmann Brothers, 4322 W. Monte Cristo, Glendale, AZ 85306; (602) 938-6921.



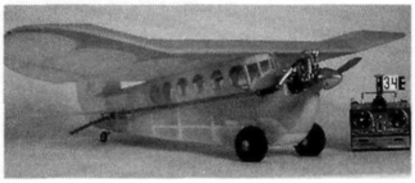
WOTAN RESEARCH INC.

Piston Fuel Pump

This efficient device will accurately dispense and filter fuels of up to 20 percent nitro directly from your primary fuel container into your model's tank, and it can also precisely measure the fuel left in the tank after a flight. The pump comes with complete instructions.

Price—$9.75 (plus $2 S&H).

Wotan Research Inc., 9 Cedar Ct., Flemington, NJ 08822; (908) 284-9290.



CLANCY AVIATION

Big Lazy Bee

This .40-size plane has a low stall speed and excellent maneuverability and handling. The kit features precision-cut balsa and plywood parts, detailed (rolled) plans and all the required dowels, axles and tail springs. An extended-wing kit is also available.

Specifications: wingspan—5 ft. (extended wing—6 ft.); wing chord—21 in.; wing area—1,184 sq. in. (extended wing—1,435 sq. in.); length—39 in.; weight—4 to 5 lb. (extended wing—6 to 7 lb.); wing loading—7.8 to 9.8 oz./sq. ft. (extended wing—9.6 to 11.2 oz./sq. ft.); radio required—3- or 4-channel; power required—.25 to .45 glow or diesel engine, .45 to .70 4-stroke or .25 to .40 electric motor.

Prices—$109; $119 (extended-wing version).

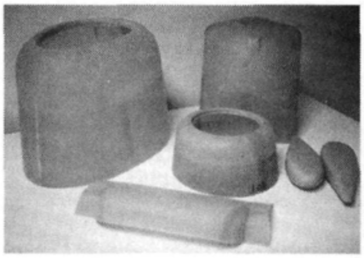
Clancy Aviation, 219 W. Second Ave., Mesa, AZ 85210; (602) 649-1534.

WAHL CLIPPER CORP.

Filer/Sander

Reach small, nearly inaccessible places with this handy, corded reciprocating tool. The filer/sander works with wood, plastic and metal and comes with 19 accessories and a convenient storage/carrying case.

Wahl Clipper Corp., P.O. Box 578, Sterling, IL 61081; (800) 735-9245.



TAKE FLIGHT MODEL & MOLD INC.

Fiberglass Replacement Parts

These professionally crafted parts are made of polyester resin with fiberglass cloth reinforcement. Take Flight now offers parts for the Midwest AT-6 Texan and 300S, Jim Meister's P-47 Jug and Global Hobbies' Skyraider and 40/60-size Skylane, and they will have parts for other aircraft soon.

Prices—$28, $14, $40 (AT-6 cowl, wheel well/set); $29, $10, $37 (300S cowl, wheel pants/set); $48, $20, $65 (P-47 cowl, razorback/set); $10 (Skyraider or Skylane cowl). Please add $5 S&H for each part or set ordered.

Take Flight Model & Mold Inc., 5350 McIntosh Point, Ste. 120, Sanford, FL 32773; (407) 328-8124, fax (407) 328-8350.

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GIANT-SCALE KITS: From Jim Meister Plans. P-51, Spitfire full wood kits. 109, Corsair, 190, P-47 semi-kits. Squint scale 81", P-40B from Tim Farrell Flight Plans. Custom cutting also available. Send SASE to Starlight Hobbies, P.O. Box 626, Stone Ridge, NY 12484-0626, or call (914) 687-4737 between 6-10 pm. [9/95]

GEE BEE plans (Benjamin used). Twelve airplanes, ⅓, smaller. Shirts! Catalog/News $4. Vern, 308 Palo Alto, Caldwell, ID 83605; (208) 459-7608. [10/95]

COLLECTION FOR SALE: Over 350 kits from 40's, 50's, 60's, F/F, R/C, U/C, Rubber, Solids, Jetex. Send SASE ($.55), or call (914) 967-5550. [1/96]

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NATIONAL COMPETITION FUN FLY ASSOCIATION (NCFFA) NATIONALS, Sept. 2 & 3, 1995; Madisonville, KY. Contact Harold Parker, Route 1, Providence, KY 42450; (502) 667-5486. [8/95]

FINAL APPROACH

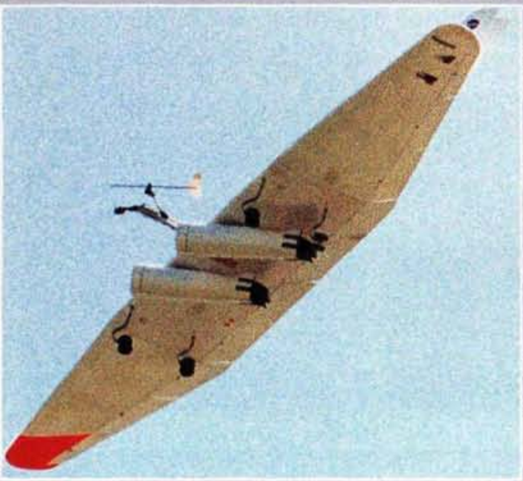
OBLIQUE FLYING WING

NASA has been studying an oblique flying-wing configuration for use as a 400-passenger SST that would fly from L.A. to Tokyo at Mach 1.6 but have the same ticket price as a 747. Such a craft would be huge, with a wingspan of 410 feet, and it would fly with one wingtip yawed forward and one yawed aft. The "oblique, all-wing, small-scale demonstrator" is an R/C aircraft that was built and flown to study the handling qualities and research the feasibility of this inherently unstable asymmetrical all-wing design.

Two small vertical fins mounted at the aft wingtip were found to generate the smallest pitch coupling. Stephen Morris (center) noted that the cost of the airplane was very much on his mind as he opened the throttles to start the first flight!

The $30,000 model was designed and built at the Stanford University Flight Dynamics Research Laboratory by research associate Stephen Morris and graduate student Ben Tigner under the direction of associate professor of aeronautics and astronautics Ilan M. Kroo. The project was funded by a NASA Ames Research Center grant.

The 20-foot-span, 80-pound, twin ducted-fan-powered plane is an all-composite structure with an aluminum spar. Wing skins are molded out of a Kevlar and foam sandwich, 1/16 inch thick, and the trailing-edge control surfaces are made of balsa and are covered with Mylar film. There are 10 trailing-edge control surfaces: three on each outboard wing panel and four on the center panel. An onboard 68020 computer with a math co-processor reads pilot commands and combines this information with output from six onboard sensors to produce control deflections that stabilize and maneuver the airplane. The sweep angle in flight varies from 35 degrees at takeoff to 68 degrees at cruise.



The oblique wing is flying right to left; note the weathervaning track indicator mounted on the leading edge. When the wing is yawed to 45 degrees or more, which are the roll and pitch axes? The conventional orientation of these axes relative to the span of the wing proved more workable. This raises the question: which direction should the pilots face in a full-scale version?!

Two BVM .91R Viojett ducted-fan units are attached below the wing. Vanes in the jet nacelles deflect the exhaust slightly downward to eliminate any pitch coupling (the vanes effectively place the thrust line through the model's CG). A large-radius inlet was used on the custom-built nacelles to optimize thrust at the model's low flight speeds of around 60mph. At sea level, the two 5hp engines in these nacelles spin at approximately 23,000rpm and provide around 12.3 pounds of static thrust each. The nacelles and four sets of landing gear swivel to accommodate the skewed flight angle.

The radio is a JR 10-channel PCM; 18 servos are on board: JR 4721 high-speed, high-torque servos for the control surfaces; JR 1/4-scale servos turn the landing gear.

The takeoff run lasts 22.5 seconds, and the liftoff air speed is 45mph. The aircraft flies well, but because of the speed with which the computer must input control-surface corrections, the model airplane servos operate close to their rate limit. As a result, there is a barely noticeable, 1-foot vertical oscillation in level flight that occurs between 30 and 60mph. The original design had fins on each wingtip. Earlier tests with the plane mounted on a universal joint attached to the top of a car showed that the vertical fins produce a pitching moment when loaded and that this coupling can exceed elevator authority. Smaller, multiple fins attached only to the trailing wingtip helped minimize this effect.

Turning also offered some surprises: a turn toward the forward wingtip was more unstable than a turn toward the trailing wingtip. Turning toward the trailing tip also resulted in the loss of some of the yaw angle when the plane straightened its track.

The first flight last year lasted approximately 4 minutes and included two large patterns around the field. The maximum sweep flown was 50 degrees. Steve notes, "It sure looked strange in the air, and the sound of those two fan units running wide open was quite unusual." The plane has not flown since then because project funding ran out. Future objectives include the use of faster servos, steeper right and left turns, flight at 65 degrees of sweep and further exploration of stall characteristics. The program was a dramatic, successful demonstration of a relatively low-cost methodology—R/C modeling—to confirm the feasibility of an unusual, computer-developed SST design. *—Tom Atwood*

The onboard 68020 PC continually corrects the wing's attitude and records flight data. Eleven data channels are recorded 10 times a second and are stored in the computer's RAM.